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Air Repair

Vol. I, No. 4 May, 1952

COME TO CLEVELAND!

AIR POLLUTION AND SMOKE PREVENTION ASSOCIATION OF AMERICA
4400 FIFTH AVENUE PITTSBURGH 13, PA.

Founded 1907

Air Repair

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Published by

AIR POLLUTION AND SMOKE PREVENTION ASSOCIATION OF AMERICA

4400 Fifth Avenue Pittsburgh 13, Pa.

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PRINTED IN U. S. A.

Everybody is going to

Cleveland!

You just can't afford to miss Cleveland this year.

There, in the Hotel Statler, the Air Pollution and Smoke Prevention Association of America will hold the best annual meeting of all — its 45th — and plans are being completed not only to provide members and guests with four days of fact-filled sessions, but their entertainment in this hospitable city won't be neglected either!

The annual meeting will be held from June 9 to 12, at a time when Cleveland's climate is at its best. And if you've never seen the sparkling waters of Lake Erie before, now's your chance. Don't miss it!

Walter O. Everling, Director of Research, American Steel and Wire Company, is chairman of the convention. Heading the committee on local arrangements is Herbert G. Dyktor, Commissioner of Cleveland's Division of Air Pollution Control.

These men, working with a 15-man Finance Committee and a 41-man Citizens Committee, are going to assure you of a bang-up meeting. Incidentally, the word "man" is a trifle incorrect, for a number of prominent Cleveland ladies have been active on the Citizens Committee for some time.

Make your reservations at the Statler early, and be sure to register with the Convention Committee. The registration fee for the men is $1, and nothing for the ladies. Make out your check to LeRoy Diehl, Treasurer, Room 316, 1404 E. 9th Street, Cleveland 14, O.

And while we're on the subject of ladies, here's what the Convention Committee has planned for them:

Mon., Jun. 9—Get-acquainted tea.

Tues., Jun. 10—Luncheon and style show.

Wed., Jun. 11—Three-hour trip around Cleveland, one of America's finest cities. Sightseeing buses with astradomes will be used, so that the riders can see up as well as out when they rubberneck. The ladies will also be taken to the observation floor of the Terminal Tower, and they may visit the Health Museum, if they wish, as well as the Thompson Auto Album with its quaint ancient-vintage automobiles.

Tentative Program

That's what it was called in the last issue of AIR REPAIR, and that's what it will have to be called now, since changes and additions are being made with every passing week.

But rest assured, you're not going to get *less* than what is mentioned here. When Walter Everling and Herb Dyktor get through with their plans, you're going to wonder whether you will have time to take everything in!

These men and their associates are running a temperature, and they want it to be infectious! And think of the memories you will take home with you. Meeting of old acquaintances under happy circumstances, good food and entertainment, bull sessions in smoke-filled rooms, plus a deluge of technical information which has been worked up by air

Downtown Cleveland looks like this from the air. In the foreground is the Terminal Tower, facing Euclid Square. The Mall is at right center, next to the Cleveland Auditorium. The Cleveland Stadium is the horseshoe-shaped building in the left background, next to Lake Erie, which will be full of pleasure boats of all sorts at the time of the Annual Meeting.

pollution control experts during the entire year. What a bill of fare! It will be the best annual meeting you have attended for a long time. And you're going to see more of your friends in Cleveland, for enthusiasm is running high even at this early writing.

We're not going to attempt to predict the number of attendants, but both Walter Everling and Herb Dyktor plan to eat their respective grandmothers' straw hats if this will not be the largest annual meeting the Association ever held.

Remember, the Association has been revitalized, and activities are bubbling like a caldron of boiling water. It's the biggest thing of its kind on the Western Hemisphere, and it's going to grow bigger and bigger as enthusiasm for it increases.

Circle the dates on your calendar, bring your wife—but get there!

Monday, June 9

Monday morning, Committee chairmen will meet with their committees to put the final touches on the reports they will present later in the week. *Since there are 17 committees, it has been suggested by President John L. Hodges that each report be confined to five minutes or less.*

A smoke inspectors' round table will be held in the afternoon under the chairmanship of H. Kenneth Kugel, Chief Engineer, Division of Smoke Regulation and Boiler Inspection, Washington, D. C.

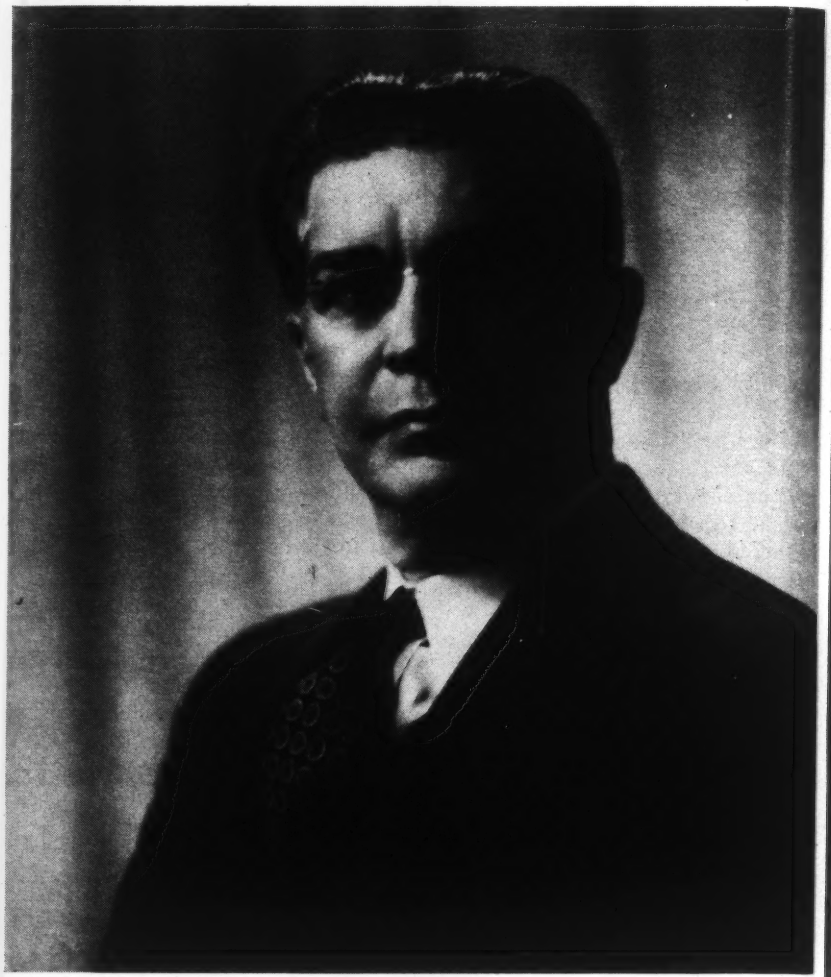
He will also be in charge of the smoke inspectors' meeting to be held in the evening.

Tuesday, June 10

F. S. Mallette, Assistant Director of Research, American Steel & Wire Company, Cleveland, will be chairman of the steel and foundry session to be held Tuesday morning.

The speakers, and their subjects, include:

George M. Dreher, General Technical Department, Jones & Laughlin Steel Corporation, Pittsburgh, "Pilot Plant Studies of Dust Collection for Open Hearth



Keynote Speaker

Dr. Robert A. Kehoe, who will address the Annual Meeting of the Air Pollution & Smoke Prevention Association in June as one of the principal speakers, has a distinguished medical record. He has been Director of the Kettering Laboratory in Cincinnati for the past 22 years, and is a great authority on industrial medicine.

He began his medical studies at Ohio State University and received his bachelor of science degree from the University of Cincinnati in 1918. Two years later, when he was 27 years old, he obtained his doctor of medicine degree there. In the same year he married Lucile Marshall.

His first position was that of pathologist at the Jewish Hospital in Cincinnati. At the same time he taught physiology at the University of Cincinnati, which eventually led up to a professorship, a position he held from 1939 to 1949. He has also served as medical director of the Ethyl Corporation since 1925.

Dr. Kehoe has been director of the University of Cincinnati Institute of Industrial Health since 1947, and director of the Department of Preventive Medicine and Industrial Health since 1948.

Dr. Kehoe is a fellow of the American Medical Association and a member of its Council on Industrial Health. He further belongs to the American Public Health Association, in which he has been chairman of the committee on metallic poisoning, Industrial Hygiene Section, since 1938, and the American Association of Industrial Physicians and Surgeons.

Other important memberships include the American Association for the Advancement of Science, the American Physiological Society, the American Industrial Hygiene Association, the American Chemical Society, the Central Society for Clinical Research, the Ohio Academy of Medicine, and the American Academy of Occupational Medicine.

He is a contributor of numerous articles to scientific publications, as well as chapters in reference works on industrial hygiene and toxicology. Dr. Kehoe is also a member of APCSPAA, and has supported our aims for some time. His subject at the Annual Meeting is entitled "Health Aspects of Air Pollution."

Stacks." He will present the paper in collaboration with several of his associates.

Dr. Charles A. Bishop, Research and Technology, United States Steel Corporation, Pittsburgh, will, with associates, give a paper entitled "Some Aspects of Air Pollution in the Steel Industry." Jack C. Radcliffe, Ford Motor Company, will speak on "An Industrial Stack Sampling Program," and John M. Kane, American Air Filter Company, Louisville, will discuss "The Foundry Equipment Manufacturers' View of Air Pollution Ordinances."

The afternoon will be devoted to petroleum and chemical industries and railroads. C. A. Gosline, of E. I. du Pont de Nemours & Company, Wilmington, Del., will preside. His co-chairman is D. G. Stevens, Chief, Technical Service Division, Standard Oil Company, Cleveland.

E. P. Krop, Standard Oil Company, Cleveland, will speak on "Application of Scrubbing Devices for Odor and Fume Control." He will be followed by Jack Jordan, North American Manufacturing Company, Cleveland, who will present a paper entitled "Combustion of Oil in Small Commercial Heating Units."

"Eye Irritants Formed by Interaction of Styrene and Halogen in the Atmosphere" is the title of a paper to be presented by E. M. Adams, of the Dow Chemical Company, Midland, Mich.

H. C. Hosford, of the E. I. du Pont de Nemours & Company, Grasselli Chemicals Department, Cleveland, will speak on "Chemical Plant Air Pollution Control." "HF Tail Gas Absorption" is the title of the paper to be read by R. W. Tomlinson, of the Pennsylvania Salt Manufacturing Co., Calvert, Ky.

G. E. Best, who is serving as co-chairman of the session, will summarize the afternoon's contributions. He is a member of the Air Pollution Abatement Committee of the Manufacturing Chemists' Association.

W. O. Everling

CONVENTION CHAIRMAN

Walter O. Everling, Research Director of the American Steel & Wire Company, Cleveland, and a Vice President of the Air Pollution and Smoke Prevention Association of America, is responsible for the excellent program to be presented at the Annual Meeting.

And a better man couldn't have been chosen!

He has been active in Association matters and has attended many of our national conventions. Those interesting wrinkles on the left side of his face are dueling scars which he received when he attended the University of Munich. He was graduated with the degree of mechanical engineer in 1926 and came to the United States a year later.

After serving as draftsman for the old Carnegie Steel Company, Mr. Everling became associated with the American Steel & Wire Company, and his rise in that organization has been steady.

He has been Director of Research since 1944. He is a member of both the British and American Iron and Steel Institutes, the American Society for Metals, the ASME, and the American Chemical Society.

George G. Ritchie, Chesapeake & Ohio Railroad, Richmond, Va., will be in charge of the railroad program.

Wednesday, June 11

E. D. Benton, Director, Research & Fuel Engineering, Ohio Coal Association, Cleveland, will be general chairman of the Wednesday session, which will concern itself with solid fuel air pollution problems.

The chairman for the morning meeting is D. W. Williams, Manager, Cleveland Office, Babcock and Wilcox Company, and he will introduce the following speakers:

Otto de Lorenzi, Director of Education, Combustion Engineering-Superheater, Inc., New York, "The Combustion of Solid Fuels—Effect of Coal Quality on Boiler Performance and Air Pollution." Earl C. Miller, Design Engineer, Riley Stoker Corporation, Worcester, Mass., "Water Tube Boilers and Their Design When Fired by Spreader Stokers and Their Relation to Air Pollution."

Max C. Funk, District Superintendent of Service and Erection, Combustion Engineering-Superheater, Inc., New York, "Spreader Stokers and Their Relation to Air Pollution." Philip F. Best, Chief Mechanical Engineer, The Thermix Corporation, Greenwich, Conn., "What the Mechanical Type Dust Collector Industry is Doing to Meet the Problems Presented by Spreader Stoker Fired Water Tube Boilers."

Afternoon Session

A. A. Casey, General Superintendent of Steam Power, Cleveland Electric Illuminating Company, will preside. The following speakers have been scheduled: R. W. Van Duzer, Assistant Engineer of Power Plants, Detroit Edison Company, "Problems Encountered in the Conversion of Existing Large Coal Fired Boilers to Conform With Present Day Air Pollution Codes." L. W. Cadwaller, General Superintendent of Generating Station, Potomac Electric Power Company, Washington, D. C., "Application and Performance of Modern Dust Recovery Equipment on Large Coal-Fired Boilers."

Curtis Lee Smith, Executive Vice President, Cleveland Chamber of Commerce, "Economic Aspects of Air Pollution Control."

Mayor Thomas A. Burke, Mayor of Cleveland, will welcome the members at the annual banquet, which will be held at 7 p.m. Wednesday night. The banquet will be followed by floor show and dance.

Thursday, June 12

Final day of the meeting. The business session of the Association will be held in the morning. President John L. Hodges will be in the chair. *Be sure to take in this meeting. A number of subjects to be presented will have a most important bearing on the future of the organization. They must be settled at this meeting.*

On the closing day of the meeting Dr. Robert A. Kehoe, Director of the Kettering Laboratory, College of Medicine, University of Cincinnati, will deliver the keynote address.

It will be given in the afternoon and is entitled "Health Aspects of Air Pollution."

George E. Best will deliver a paper entitled "A Rational Approach to Air Pollution Legislation," while Joseph A. Crowley, Director of Law, City of Cleveland, will speak on "The Legal Aspect of Air Pollution Ordinances."

The new President of the Association will then call for adjournment.

Citizens Committee

The Citizens Committee on Air Purification, Cleveland, which is so interested in having our annual meeting there, is composed of the following:

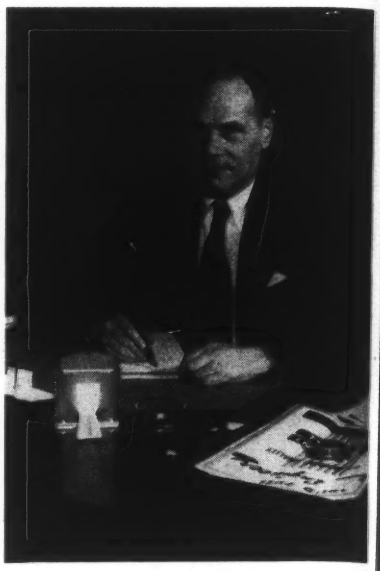
Raymond S. Bieber, the Euclid Avenue Association
Ernest J. Bohn, Director, Regional Association
Frank S. Chopp, Manager, the Standard Building
Mrs. Donald Crockett
LeRoy Diehl, Department of Public Health and Welfare
Owen M. Fox, Cleveland Cliffs Iron Company
John P. Freeman, Operating Engineer, John Hay High School
Dr. B. G. Gebhard
Charles B. Gleason
Howard Whipple Green, Cleveland Health Council
J. Dean Halliday, Anti-Tuberculosis League
William Kammerer, Consulting Engineer
Mrs. E. J. Kenealey, President, Women's City Club
Karl Kaserman, Building Manager
Bronis Klementowicz, City Council
Wilson Leece, Secretary, Laundry Institute
Walter Lhaman, Plant Superintendent, Fuller Cleaning & Dyeing Company
Mrs. Walter Magee
William E. Malm, Real Estate Broker
Thomas Marsh, Manager, Corporation Sales, Iron Fireman Manufacturing Company
Mrs. George J. Mateja
E. B. McConnell, Standard Oil Company
R. J. McSoley, Manager, Statler Hotel
Mrs. John Oertel
Charles Oswald, Advertising
Sherwood Parsons, President, Parsons Engineering Corporation
G. H. Rankin, Works Fuel Engineer, American Steel & Wire Company
John Rohrick, Vice President, Teamsters' Council
Warner Seely, Secretary, Warner & Swasey Company
E. H. Shealy, Secretary, Railway Operation Committee
Leonard Smith, President, Broadway-East 55th Street Merchants & Manufacturers Association
Admiral Lyndon Spencer, Lake Carriers' Association
Rev. Raymond Spoerri
Stephen Suhajcik, Chairman, Public Health & Welfare Committee
Cyril Tasker, Division of Research, American Society of Heating & Ventilating Engineers
R. B. Textor, Consulting Engineer, Textor Laboratories
Ezra Van Horn, Executive Vice President, Ohio Coal Association
Prof. F. H. Vose, Case Institute of Technology
Earl Westcott, Chief Engineer, the May Company
R. E. Butler, Chairman, Cleveland Railroad Operating Committee
Albert Fahrland, Jr., Fahrland Fuel

MEET YOUR HOST

Herbert G. Dyktor, Commissioner of the Cleveland Division of Air Pollution Control, is one of the most colorful members of the Asociation.

He was born in Nice, France, of Dutch parents, and was educated in France, Belgium, Austria, and England. He was graduated from the London Polytechnic Institute and served in the British Army during World War I.

Subsequent to engaging in engineering and business activities on both sides of the Atlantic Ocean, he joined the



HERBERT G. DYKTOR
Commissioner
Division of Air Pollution Control, Cleveland

The Thompson Products Auto Album and Aviation Museum, with its Gay Nineties Main Street, is a "must" on every visitor's schedule. It is open daily from 1 to 5 p.m., and evenings on Wednesdays and Fridays from 7 to 10 p.m.

staff of the State of Missouri in 1931 and held the position of Chief Industrial Hygiene Engineer, with headquarters in St. Louis.

In 1939 Mr. Dyktor was offered the same position by the State of Michigan, with headquarters in Detroit and Lansing. He occupied the position for five years, then came to Cleveland to organize a Bureau of Industrial Hygiene.

In 1946 he was asked to reorganize the existing smoke control service. After passage of the necessary legislation on July 1, 1947, he became Cleveland's first Commissioner of its Division of Air Pollution Control.

Commissioner Dyktor has written numerous articles on industrial hygiene and air pollution problems, and he has been chairman of many national technical committees. He is a past president of the American Conference of Governmental Industrial Hygienists, and a past chairman of the industrial hygiene section of the American Public Health Association. His other professional memberships include the American Industrial Hygiene Association, the Conference of Municipal Public Health Engineers, and the national, state, and Cleveland Society of Professional Engineers.

WHERE DOES INFLATION LEAVE FIXED SALARIES?

by LOUIS C. MCCABE
Chief Fuels and Explosives Division
U. S. Bureau of Mines
Washington, D. C.

It was with a great deal of concern that I followed the recent demands for pay increases, since apparently we are not yet through with the inflationary spiral that began in the United States in the fall of 1945.

I am disturbed because while the working man will no doubt obtain some increase in his pay envelope, many others, such as the municipal air pollution control officials with whom I keep in constant touch, will not receive a particle of benefit.

As a matter of fact, their living conditions will be worsened unless intelligent administrations come to their rescue.

A plumber in metropolitan cities can make nearly $30 a day in these times. An upholsterer and cabinet maker can earn between $20 and $30 without trouble. While the skills these men represent are certainly necessary to maintain our high standard of living, they do not compare with the type of background needed by an air pollution control official.

I am safe in saying that no air pollution control official earns anything like $30 a day, or even a substantial part thereof. Yet these men are charged with a great responsibility. They must not only have sound engineering backgrounds, but they must also know a great deal about finance, administration, sociology, and public relations. The men I have come in contact with are, for the most part, men of extremely high caliber, who through love of their jobs have turned their backs on positions in industry which would be far more lucrative.

I believe that such devotion should be recognized and rewarded by the municipalities to whom these men are giving such outstanding service.

The Auto Album is the brainchild of Frederick C. Crawford, President of Thompson Products, Inc., manufacturers of automotive and aircraft parts. It started with the purchase of a 1905 Duryea in 1937, and has grown continuously since then. The old cars are spotted by the company's salesmen.

NEW ZEALAND MAY USE NATURAL STEAM POWER

In view of the coal shortage and the fact that the end of river development for power is not many years distant, New Zealand may use natural steam emitted at high pressure from deep bores in the thermal regions of the center of Rotorua, the north island. The steam will be used as a new source of electric power.

The government tests thus far have been increasingly hopeful, and it seems certain that a large and constant supply of steam is waiting to be tapped, according to a report filed by Canadian Press.

Large numbers of bores have been sunk to considerable depths. Most of them have so far emitted "wet" steam, which can be used for power, but which is not as suitable as "dry" steam, usually tapped at greater depths.

ENGINE RUNS ON SAWDUST

The lumberman's dream of running his sawmills with power derived from waste wood came a step closer to reality when two engineers reported in the development of an experimental sawdust-fed gas turbine.

George H. Atherton and Stanley E. Corder, of the Oregon Forest Products Laboratory, Corvallis, Ore., told a meeting of the American Society of Mechanical Engineers in Seattle recently that the turbine reached combustion efficiencies up to 99 percent.

CONTROLLING CORROSIVE AIR POLLUTANTS

by KEMPTON H. ROLL
Lead Industries Association
New York, N. Y.

The Donora Smog Episode*, the Poza Rica Toxic Gas Episode†, the Los Angeles problem with sulfurous gases‡, and, in general, the complaints of many localities situated near industrial operations have all served to point up the importance of controlling air pollution caused by corrosive air pollutants, of which sulfur dioxide and sulfuric acid mist appear to be the chief offenders.

Though the problem has been brought in public focus more recently, it has actually been under study for many years. Forty-two years ago, the American Smelting & Refining Company at Selby, Calif., installed the first satisfactory commercial electrostatic precipitator to suppress acid mists produced during gold and silver parting operations. Converting waste sulfur dioxide gases has been an important source of sulfuric acid for more than half a century, and in the last five years, according to *Chemical Week*, some 20 to 25 chemical plants have spent $19,000,000 on added facilities to control air pollution alone and pay a bill of $5,000,000 a year to operate them.

Problem Not New

Because the air pollution problem is not new, industry has had ample time to develop and perfect appropriate controlling equipment. The approach to the control of corrosive air pollutants has followed two general courses of attack, depending on whether the effluent is an aerosol or a gas.

In the case of an aerosol, such as sulfuric acid mist, the problem is simply one of collection. If the particles which are small enough to float in air can be coalesced or agglomerated into larger particles, they can thus be prevented from polluting the air.

In the case of a gas such as sulfur dioxide, an entirely different control technique must be utilized. Two that are in commercial use are: 1) conversion of the sulfur dioxide to sulfuric acid providing the volume warrants the expense, and 2) absorption of the gas in chemicals from which it can be recovered as pure sulfur dioxide.

In the case of hydrogen sulfide, a less corrosive but more toxic gas, the approach has been similar to that used on sulfur dioxide. One method is to burn it in air to convert it to sulfur dioxide and water vapor.

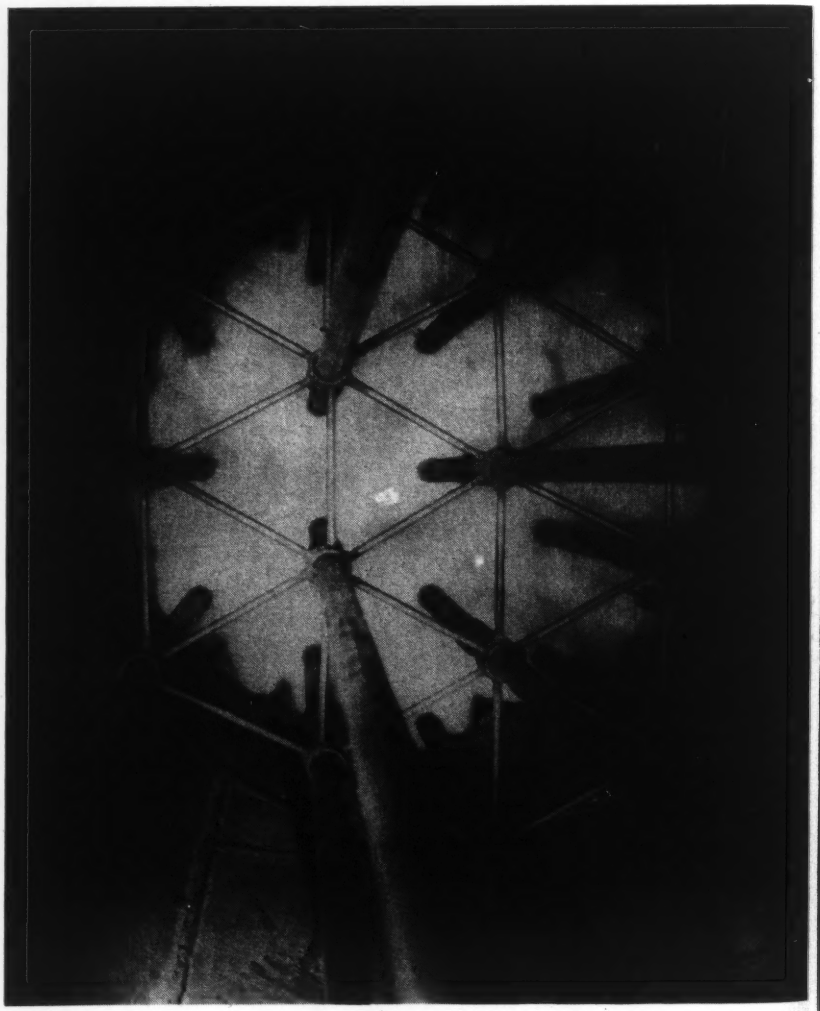
$$2H_2S + 3O_2 = 2H_2O + 2SO_2$$

Another is to burn it in the presence of sulfur dioxide to convert it to elemental sulfur and water vapor.

$$2H_2S + SO_2 = 2H_2O + 3S$$

Hydrogen sulfide is now being treated in a number of oil refineries by means of either of these methods. One refinery in

Looking down throat of a Pease-Anthony Venturi scrubber. White area is a curtain of fine water spray for wetting acid mist particles.



* In October, 1948, 19 persons died within a period of five days and several thousand more became seriously ill at Donora, Pa. In the words of U. S. Surgeon General Leonard A. Scheele: "It was not until the tragic impact of Donora that the nation as a whole became aware that there might be a serious danger to health from air contaminants."

The causes of the disaster, according to U. S. Public Health Service investigators, could be laid to a peculiar combination of three conditions: 1) the presence of sulfur dioxide and some acid mists in the air; 2) the presence of solid particulate matter in the air, and 3) the weather: an inversion roof of impenetrable warm air pressed down on Donora, permitting these pollutants to concentrate but not escape from the enclosed valley.

† Hydrogen sulfide-bearing gases escaping from a refinery flare plus temperature inversion and fog caused 320 casualties, including 22 deaths, on November 24, 1950 in Poza Rica, Mexico, site of the Pemex oil refinery.

‡ "Some 822 tons of sulfur dioxide formerly entered the Los Angeles atmosphere every day," said the Director of the Los Angeles Air Pollution Control District.

the Los Angeles area is producing sulfur at the rate of 50 tons per day from gases that were formerly burned to introduce 100 tons of sulfur dioxide into the atmosphere per day!

Sulfuric Acid Mist

Sulfuric acid is recognized as the work horse of the chemical process industries, and where it is used as a hot acid, the presence of sulfuric acid mist very often becomes an air pollution problem of considerable magnitude.

The electrostatic precipitator, oftentimes referred to as a "Cottrell," provided one of the earliest effective means for suppressing this corrosive air pollutant. Today it is common practice to add an electrostatic precipitator at the end of the processing circuit through which all gases bearing sulfuric acid mist must pass.

As the gases pass through the precipitator, they receive electrical charges which cause them to agglomerate or coalesce. The charged particles of acid collect on the precipitator walls and, due to their own weight, descend to the bottom for removal.

100 Percent Efficiency Possible

The normal efficiency of an electrostatic precipitator generally ranges from 90 to 95 percent; the balance of 5 to 10 percent acid mist still escaping to the air may or may not constitute an air pollution hazard depending upon the locality.

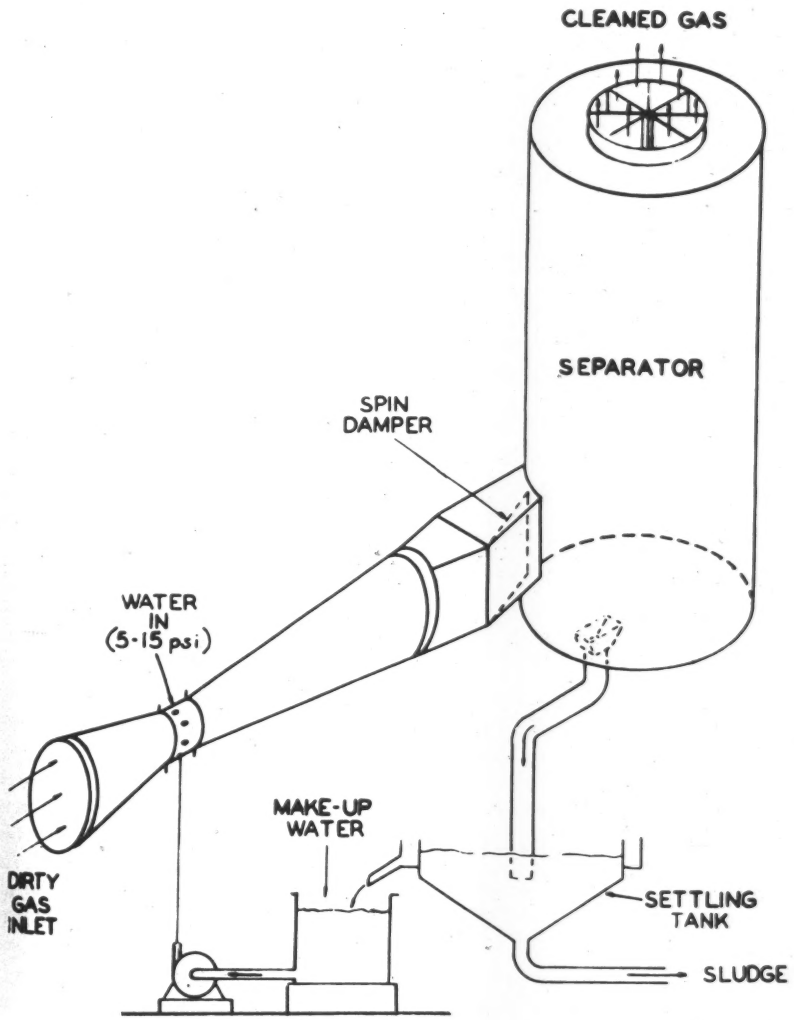
Theoretically, a precipitator can be operated up to 100 percent efficiency, but the extra equipment required generally adds disproportionately to the cost. In the case of a large chemical company located in a heavily populated area of New Jersey there was little choice; collection efficiency had to be raised well up within the 96 to 99 percent range.

This was accomplished by means of a minor modification on a conventional precipitator. A lead-lined steel dome was added to the top and equipped with a sheet lead stack supported by a steel framework, thus bringing the total added height to 30 feet.

The dome served a dual function: to cool the gases further and also insure that the uppermost section of the precipitator chamber would operate effectively regardless of wind and weather conditions. Performance tests on the modified precipitator showed that an intake of corrosive mist containing 325 mg per cubic foot of sulfuric acid was reduced to the very low value of 1.4 to 5.0 mg. per cubic foot at the exit.

Diagram of Pease-Anthony Venturi scrubber. Separator is lead-lined. Settling tank and tank for make-up water and handling lines are constructed of lead and lead pipe when used for treating sulfuric acid mists.

Courtesy Chemical Construction Corporation.

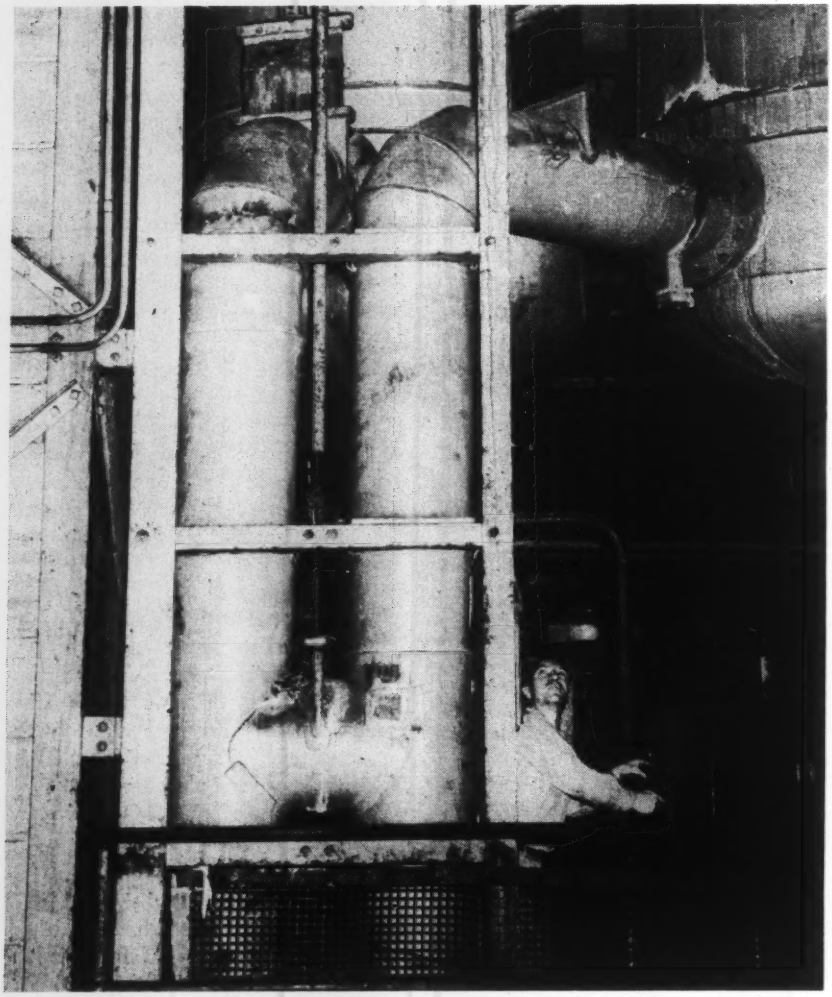


Made of Chemical Grade Lead

The material of construction of all electrostatic precipitators for handling sulfuric acid mists is principally of chemical grade lead; that is, lead containing 0.002 to 0.02 percent silver and 0.04 to 0.08 percent copper. The method of construction is generally the cage type; that is, the sheet lead is supported in a steel framework which exposes the bulk of the metal's surface to the cooling effects of the outside atmosphere.

Precipitator tubes, electrodes, acid pipe and all other surfaces exposed to either the mist or the precipitated acid are made of lead, either of unalloyed chemical grade or of lead plus 6 percent antimony where greater strength is needed.

Another device that has more recently entered the field of corrosive air pollutant control is the Venturi scrubber. In this device the acid mists are pulled through the constricted throat of a Venturi tube where the particles encounter a high velocity water spray (flow rate of about 250 feet per second).



Modified Cottrell sulfuric acid mist precipitator, part of a "Chemco" drum-type sulfuric acid concentrating unit shown on right.
—Photo courtesy Calco Chemical Division.

The water particles are intentionally broken up to approximate the size of the acid mist particles, the object being to combine the acid particles with water and thus increase their weight to the point where they will no longer float.

After passing through the throat, the weighted particles enter a cyclone chamber where their velocity drops, they collect on the sides and then flow down to the bottom of the chamber for withdrawal.

The clean gas, free of acid pollutants, is drawn out of the top of the chamber through blowers and thence to the atmosphere. For handling exhaust gases at the rate of 50,000 to 60,000 cubic feet per minute, about four or five gallons of water are used per minute. However, this is recirculated to reduce the overall water consumption.

Since the spray water picks up acid mist and thus becomes dilute sulfuric acid, all areas coming in contact with it are protected with lead. The cyclone chambers are usually lead lined and the settling chambers, pumps and piping used to recirculate the water are also constructed of lead.

Sonic Agglomerator

Another apparatus developed expressly for air pollution control is known as the sonic agglomerator or collector. This type of collector operates on the principle that high intensity sound will cause particulate matter to agglomerate.

The mist-laden gases are led into a sound chamber where they are exposed to a very high intensity sound field generated by a compressed air operated siren. In one installation, the volume of gas carrying the mist moves at the rate of 24,000 cubic feet per minute and is at a temperature of 125 deg. F.

The lead-lined chamber is perhaps 35 feet high and eight feet in diameter. After coalescing, the particles are passed into the sheet lead cyclone where they are separated from the exhaust which proceeds out through the top.

About half of the collection occurs on the inner walls of the tower, the remainder within the cyclones. Exit gases leaving the sonic collector are reported to contain between two and three mg. of 100 percent sulfuric acid per cubic foot.

Actually ultrasonics are not involved in the operation of this equipment. Originally, research seemed to indicate that ultrasonics or supersonics were the approach to sound conglomeration but later experiments showed that better results were obtained when the sound frequency was dropped down into the audible range though kept at a very high intensity. Fortunately, the noise problem has been overcome through the use of special sound insulating material wrapped around the sound chamber.

By using any of the equipment thus far described it is a comparatively simple matter to control the escape of acid mists. However, our brief descriptions do not imply that other methods are not equally effective, depending upon the conditions encountered.

For example, a simple coke box will suppress a fair percentage of acid particulate matter. A coke box is merely a sealed box full of ordinary coke through which mist-laden gases are passed, the mist particles being entrained in the coke interstices. In addition, there are several varieties of cyclones and other types of precipitators, all of which will suppress aerosol air pollutants to varying degrees.

Corrosive Gases

Sulfur dioxide is one of the principal corrosives associated with air pollution that is of a truly gaseous nature. The time-tested method for preventing air pollution by sulfur dioxide has been to collect, clean and convert the gas to sulfuric acid, a method which has proven in many cases to be not only effective but

economical as well by providing a readily salable product.

Non-ferrous metallurgical operations which usually involve the roasting and sintering of sulfide ores produce substantial quantities of waste gases bearing sulfur dioxide. The early problems that arose as a result of permitting these gases to escape freely to the atmosphere are common knowledge.

The so-called "smoke farmers" who located in areas adjacent to metallurgical smelting operations, it is reported, made more money from law suits than crop raising. But today they'd not fare so well, for waste gases, particularly sulfur dioxide, are almost universally removed before entering the atmosphere.

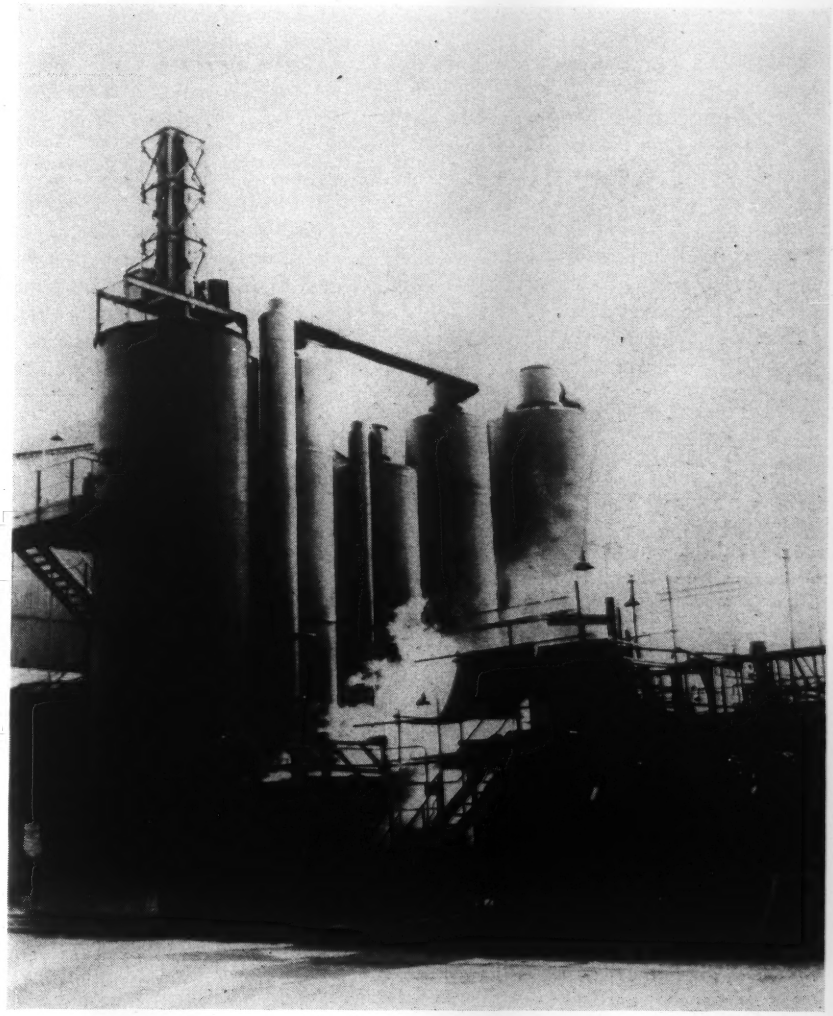
Standard practice is to first wet the hot gas to cool it and also knock down some of the heavier particulate matter, pass the gas through mist Cottrells or electrostatic precipitators which remove the balance of the solid suspended matter, cool the gas by passing it through lead pipe cooling coils and then convert it in conventional contact process equipment to high concentration, high purity sulfuric acid.

In many installations where the volume of gas is large and the percentage of sulfuric dioxide is in the neighborhood of 2 to 3 percent, it is more economical to convert the gas to sulfuric acid in modern Mills-Packard chambers which operate more efficiently than a contact plant under low sulfur dioxide concentrations.

Since a ready market exists for liquid sulfur dioxide, a more recent practice on the part of many operators faced with the task of eliminating sulfur dioxide air pollution is to collect, purify, and compress the gas for sale as liquid 99.997 percent sulfur dioxide.

Dimethylaniline Used

One of the newest and most successful methods involves dissolving the impure gas in cool dimethylaniline and extracting it as pure sulfur dioxide by heating the pregnant dimethylaniline solution. The dimethylaniline is, of course, regenerated and returned to the circuit for re-use. Here again, because dimethylaniline sulfate (dimethylaniline plus sulfur dioxide) is corrosive to practically all materials of construction with the exception of lead, almost the entire absorption, regeneration, and purification process is conducted in lead-protected equipment.



Towers specially constructed for absorption of unconverted sulfur dioxide from conventional contact sulfuric acid plant. The lead-lined absorption tower is shown on the left. At the base of the towers are acid storage tanks and sulfur dioxide cooler.
—Photo courtesy Calco Chemical Division.

Depending on their availability, sulfur dioxide may be absorbed for regeneration in other chemicals: various alkalies, ammonium compounds, tri-potassium phosphate, diethanolamine, etc. One chemical company, for example, dissolves waste sulfur dioxide in by-product sodium sulfite to form sodium acid sulfite.

In this case, the problem arose from the fact that in a typical contact acid plant all of the sulfur dioxide that enters the converter does not normally come out as sulfur trioxide. This means that anywhere from one to three percent sulfur dioxide may escape into the atmosphere.

To prevent this, plant engineers constructed equipment to utilize by-product sodium sulfite, which has the ability of absorbing sulfur dioxide to form sodium bisulfite.

The sulfur dioxide is recovered by heating the bisulfite with steam, thus freeing the sodium sulfite and returning it to the circuit. The absorption tower in this particular case consists of a steel shell 45 feet high, lined with bonded lead (lead bonded directly to steel; in effect a lead clad steel), then a layer of mill board, and finally a layer of refractory brick.

The regenerating tower is three feet in diameter, 30 feet high, and lined with bonded lead and carbon brick. The final

exit gases in the process are said to contain only 2 mg. per cubic foot sulfuric acid mist and 8 mg. per cubic foot sulfur dioxide.

This is considerably lower than the exit gases and mists of a standard contact acid plant which emit approximately 20-25 mg. per cubic foot as mist and 200 mg. per cubic foot as sulfur dioxide.

Incidentally, this plant manages to recover about 10 tons of sulfur dioxide per day from this one operation—a fair indication of what would normally be escaping into the atmosphere.

Recovery Methods Vary

Since each problem is different, the recovery, disposal or treatment scheme for the same gas may vary widely. These variations depend on the amount of material to be disposed of, market value of recovered product, local plant conditions, etc. For example, in one company alone, hydrogen sulfide is recovered or disposed of in five different ways:

1. Discharge through stack.
2. Burning in a flare.
3. Scrubbing with water.
4. Scrubbing with alkali to form sodium sulfydrate (NaHS) or sodium sulfide (Na_2S)
5. Burning to form sulfur dioxide and feeding to sulfuric acid plant ($2H_2S + 3O_2 = 2SO_2 + 2H_2O$)

Items 4 and 5 are performed alternately, depending on the market for the sulfides. Sometimes, the hydrogen sulfide may be reduced to recover elemental sulfur depending upon market conditions.

Much more has been said and written about the various types of equipment mentioned above as well as other less commercially used methods. All those described are known to be systems in use in industry today for overcoming the problem of controlling corrosive air pollutants.

Meeting Dates Scheduled

The next meeting of the East Central Section will be held in Louisville, Ky., on September 18 and 19, 1952. The 10th semi-annual meeting of this AP&SPAA group will be in Indianapolis, Ind., on February 5 and 6, 1953. These dates were set when the group met at Akron, O., in February.

CLEANER AIR GROUP OBSERVES BIRTHDAY

The Story of the Smoke Abatement League of Hamilton County, Ohio

Excerpts from the 1951 Annual Report given by Charles N. Howison, Executive Secretary, at the 46th Annual Meeting at the Sheraton-Gibson Hotel on February 21, 1952.

The Smoke Abatement League of Hamilton County, Ohio, was incorporated under the laws of Ohio on January 29, 1906, by some 150 citizens "for the purpose of abating the smoke nuisance and preventing contamination of the air by the dissemination of noxious gases and fumes in Hamilton County." It was supported by contributions from citizens and business houses.

In 1915 the League, along with 54 agencies, helped to organize the Community Chest of Cincinnati and Hamilton County. Since that time the Smoke Abatement League has received most of its support through the Community Chest, the balance coming from direct contributions of its 353 members.

Over the intervening years the Smoke Abatement League has fought for progressively stronger ordinances attacking smoke, and for effective enforcement. In the early years its inspectors made observations, contacted firemen and plant operators, and, when necessary, prosecuted violators. With the appointment of an official enforcement agency in Cincinnati, the League broadened its program of education, research and statistics, and services to promote corrective measures.

Work With Officials

The policy of the League is to work very closely with enforcement officials, such as Charles W. Gruber, Chief Smoke Inspector for the city of Cincinnati, and with T. J. Wells, Supervisor of the Cincinnati Superintendents' Committee, which represents all railroads operating in the Cincinnati Terminal area.

As a result, we have a united program for air pollution control in the Greater Cincinnati area. Both Mr. Gruber and Mr. Wells are members of the Board of Trustees of the Smoke Abatement League.

Other members of the Board are civic leaders who represent various interests and occupations, but who are actively interested in the League's program for cleaner air. An official of each of Cincinnati's three daily newspapers is included on the Board.

Another Anniversary

Today we are also observing the fifth birthday of Cincinnati's anti-smoke ordinance. The last major change in the ordinance was made on March 5, 1947, and placed regulations on the use and sale of solid fuel for hand-fired equipment, and established annual inspection requirements.

The ordinance contained a temporary five-year clause forbidding the sale and use of solid fuels in excess of 26 percent volatile content in hand-fired stoves and furnaces. On February 6, 1952, City Council of Cincinnati "converted" the temporary clause into a permanent one.

Ordinance Succcessful

Cincinnati's anti-smoke ordinance has been a great success. Under the annual inspection and solid fuel burning requirements of the ordinance, there has been a very sharp reduction in the number of observed smoke violations in the past five years.

The observed smoke violations reported dropped from 763 in 1947 to 95 in 1951, according to the Cincinnati Bureau of Smoke Inspection. The number of violations from hand-fired equipment was reduced from 232 to 10 in the same period.

We believe the educational phase of our work to be one of the League's most important functions. A full realization of the many benefits to be gained from a clean city and a clean urban atmosphere will develop in each citizen a public consciousness of his own responsibility to the part he himself plays in this fight for community betterment.

The public must be kept constantly aware of the fact that clean air does not come as if by magic from ordinances and laws alone, but that hard work, constant attention, financial expenditures and capital investments are the keys to success.

Rapid Industrial Growth

1951 was Cincinnati's greatest year of industrial growth. There was an increase of 12,000 new jobs opened up during the period. New manufacturing enterprises and expansion of existing industrial and business facilities involved the expenditure of the vast sum of $216,820,000.

This enormous expansion of industry and the growth of our urban areas are the primary factors which make air pollution an increasing health problem. The increased outpouring of toxic substances into the air have forced the relation of air pollution to ill health upon our thinking.

A study made by the U. S. Public Health Service of the 1948 smog episode at Donora, Pa., gives evidence that air pollution can produce acute disease in a general population group.

As in the case of many of the problems which have arisen with the growth of machine civilization, air pollution emphasizes the interrelated and interdependent nature of our existence. While it may not be conclusively proved that we are our brother's keeper, without question it is clear that we may be our brother's destroyer.

Keeping Pace

Fortunately, efforts are being made in the field of smoke abatement and air pollution control to keep pace with this very sizeable broadening of Cincinnati's industrial base. Progressive industries interested in the health of their employees and the goodwill of their neighbors are doing more and more to combat air pollution.

The League's program of research and statistics includes a quarterly survey of fuel consumption requirements and availability of supplies; a monthly and an annual study of meteorological data to determine the relationship of weather to air contaminants; and a monthly and an annual dustfall analysis to determine the weight of airborne solids falling on Cincinnati's 74 square miles.

The League's 21st annual dustfall report for the 12 months ending June 30, 1951, reflects a decided reduction in the total weight of airborne solids deposited on the city of Cincinnati.

SMOKELESS CANDLES on this birthday cake made it the talk of Cincinnati at the 46th annual meeting of the Smoke Abatement League of Hamilton County. The cake, presented to the League by the Sheraton-Gibson Hotel, recognized the fifth anniversary of the city's smoke control ordinance. Frank E. Wood, Jr., left, president of the League, receives a piece of the cake from Mrs. Fred Lazarus III, member of the board of trustees, while Charles N. Howison, executive secretary of the League, watches.
—Photo courtesy Cincinnati Times-Star.

The records for the past two years indicate a reduction of nearly 11,000 tons per year, or about 30 percent less than the 36,636 tons which fell on the city during the 12 months ending June 30, 1945.

It is estimated that this 30 percent reduction in dustfall represents a monetary saving of $2,400,000 per year in reduced cleaning costs and in protection to merchandise and property.

Airborne Sewage

This means that Cincinnati homes, business places, commercial buildings, railroads and industries have prevented the equivalent of a 219-car trainload (50 tons per car) of dirt from falling on the city each year for the past two years.

This substantial reduction in airborne sewage has been an important factor in helping to make Cincinnati a cleaner, brighter, healthier and safer city in which to live.

The educational program of the League again included the promotion of Cleaner Air Week, whose purpose it is to build a better and stronger America.

This project, once identified as National Smoke Abatement Week, originated with the Smoke Abatement League and is now registered with the U. S. Department of Commerce as one of the official "weeks" of the year.

Cleaner Air Week now has among its co-sponsors the Air Pollution and Smoke Prevention Association of America, the National Coal Association, Appalachian Coals, Inc., and the Pocahontas Operators Association. The League secretary served as national chairman for the third year.

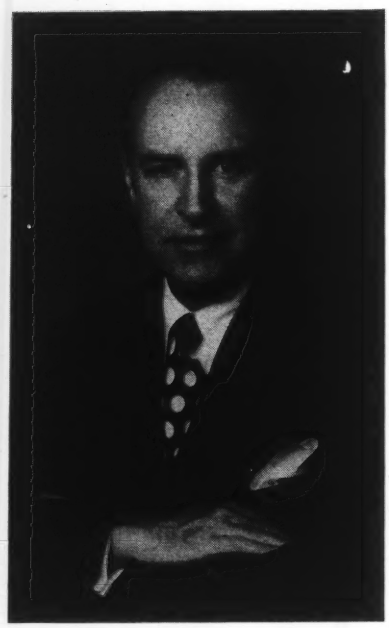
Forceful Advertising

The Pocahontas Operators Association, composed of 25 mining companies who operate in the Pocahontas field and supply a major part of the low volatile smokeless coal used in Cincinnati, ran two advertisements in Cincinnati newspapers calling attention to Cleaner Air Week.

These advertisements totalled 540 column inches, or the equivalent of three additional newspaper pages. One of the advertisements reads in part:

While much has been accomplished, eternal vigilance by all anti-air pollution forces will always be necessary to continue the present excellent progress toward a cleaner, brighter, healthier Queen City.

The League is interested in all forms of community sanitation. For example, a special effort was made last spring to have the city remove sand and cinders from city streets as early as possible, to prevent their becoming an additional source of air pollution.



Eugene C. Moffatt, Chairman of the Board of Trustees of the Smoke Abatement League of Hamilton County, is Eastern Division Sales Manager of Procter & Gamble.

This was necessary because 22,730 cu. yd. of treated sand and cinders were placed on the city streets to prevent traffic hazards during the winter.

City Plays Leading Role

Cincinnati, which has played a leading role in the fight against stream pollution, is also one of the most active communities in the fight against air pollution.

There is no exact way of comparing the cleanliness of one city with that of another, as is the case with automobile fatalities, traffic violations, or criminal acts. However, Cincinnati is generally recognized as one of the cleaner cities in the country, as far as air pollution is concerned.

It has been apparent for some time that the nature of the air pollution problem is changing with our industrial expansion. There is urgent need to bring to bear on the problem all the scientific knowledge of industry, government, and scientific institutions. With the increasing industrialization of our communities, contamination of the air around us has become a serious problem affecting all segments of our population.

Since the problem of controlling atmospheric contaminants is primarily local in character, we believe that each locality should study its own situation and draft laws adapted to local conditions. Before this can be done, however, standards for evaluation and control of air pollutants must be established.

SOMETHING ABOUT CHARLIE

Charles N. Howison, the energetic Executive Secretary of the Smoke Abatement League of Hamilton County, Cincinnati, is widely known in the Air Pollution and Smoke Prevention Association for his work in connection with Cleaner Air Week.

Cleaner Air Week, formerly called Smoke Abatement Week, originated with the Smoke Abatement League. Its purpose is to promote a united national program for cleaner air. Other sponsors besides APCSPAA include Appalachian Coals, Inc., the National Coal Association, and the Pocahontas Operators Association.

Charlie is a native of Ohio, and received his education at Ohio State University, Franklin University, and Salmon P. Chase College. His first job after completing his studies was with the Commercial Steel Casting Company, Marion, O., as a cost accountant. After six years of this work he became corporation accountant at the Osgood Company.

In 1935 Charlie joined the National Park Service as officer in charge of the Fifth Corps area, Civilian Conservation Corps, which served the Columbus and Cincinnati districts.

In 1942 he joined the sales order department of the Crosley Corporation as manager. He remained there until a year after the war, when he took over as smoke secretary of the League.

Charlie is proud of his connection with APCSPAA, but as he has a buttonhole in only one lapel, he doesn't wear the Association's emblem. You see, a blue-white-buff rosette got there first.

In this case we don't blame him. He's a member of the Sons of the American Revolution and is descended from George Weisel, who served in Capt. Marion Fost's company, Col. John Keller's regiment, Bucks County, Pa., during the Revolutionary War.

ODOR ELIMINATION AT PROCTER & GAMBLE

by V. E. Gex
Procter & Gamble Company
Cincinnati, O.

Considerable time and money has been spent by Procter & Gamble Company in the past few years in the control of odor emissions from its manufacturing operations.

While none of the materials discharged present any health hazards, the company is anxious to maintain good community relations by preventing annoying odors.

The company's efforts in respect to odor control can be divided into two categories: 1) development work in methods of odor measurement and odor removal, and 2) plant installations made as a result of such development work.

Concentration Measurement

One of the items resulting from Procter & Gamble's development program has been a device for measuring odor concentration in an odorous atmosphere, in terms of multiples of the amount of odorous material required to contaminate one cubic foot of air to the odor threshold.

This amount of odorous material has been designated one odor unit. The measuring device employs a continuous flow of filtered odor-free air into which is introduced an increasing quantity of odorous air until an odor is detected in the exit mixture.

The volumetric ratio of total mixed flow to flow of odorous sample at the time of odor detection represents the concentration of odorous material in the odorous sample in odor units per cubic foot.

This measuring device for odor concentration has given far greater reproduceability than conventional dilution techniques. Named the *Osmo*, it has proved a valuable tool in evaluating odor problems in the factory, and in measuring the performance of odor elimination equipment.

Pilot Plant

Other development work in odor removal has centered around a 100 cfm pilot plant unit, equipped with a Venturi scrubber, a packed scrubber, and an electric furnace.

This equipment has been set up in the factory to handle air and gases vented from manufacturing processes, and the effectiveness in odor removal of various scrubbing and heating conditions has been studied.

The effectiveness of each set of operating conditions is determined by using the *Osmo* to measure odor concentrations and inlet and outlet of the pilot equipment, and calculating the odor removal efficiency.

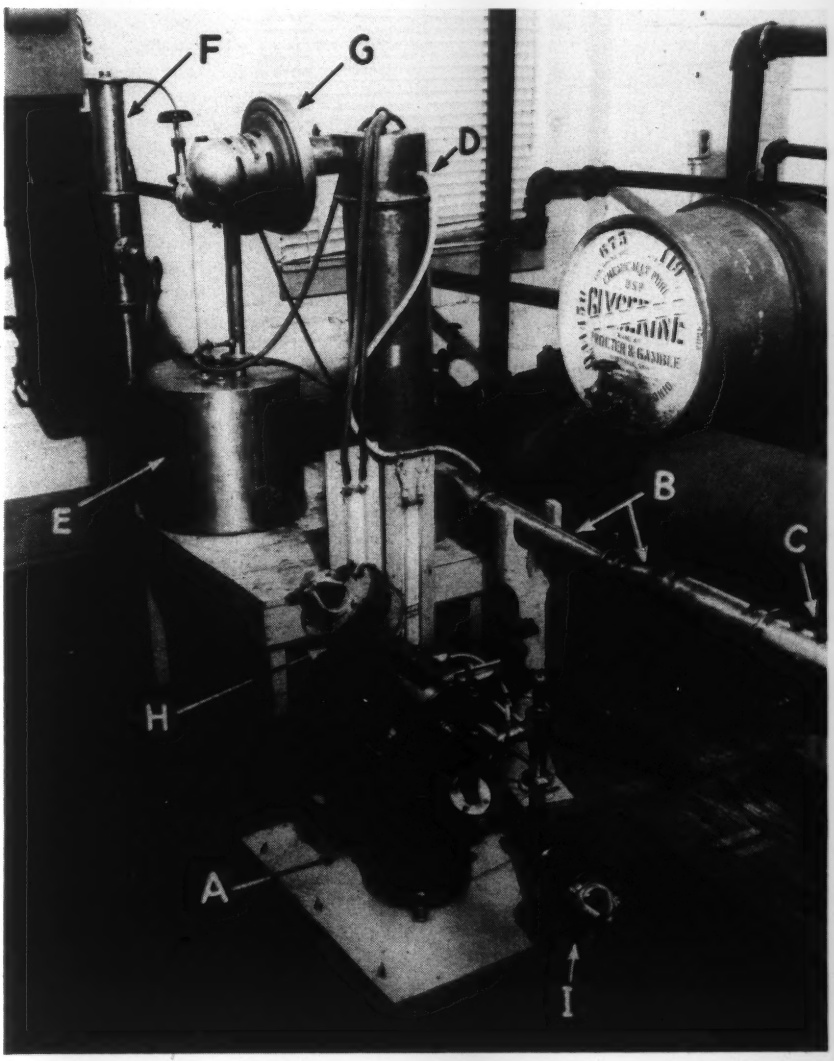
Measuring Factory Odors

Process vents are usually located on roofs or other inaccessible and unprotected spots where weather, availability of services, etc., can greatly hamper pilot plant work.

In order to eliminate these retarding factors, Procter & Gamble is currently working on the development of a laboratory method for reproducing the odors given off by factory processes.

An attempt will be made to inject controlled amounts of various odorous materials into a measured flow of air, under controlled conditions of temperature and humidity.

This is the Osmo and its companion devices. Key: A, Osmo, the odor testing device; B, Venturi scrubber; C, odorous air source; D, packed scrubber and centrifugal separator; E, furnace; F, air mixer; G, propelling fan; H, sampling fan; I, exhaust fan.



Odor removal efficiencies of various pilot plant combinations on this synthesized factory odor can then be measured in the laboratory, unhampered by the vagaries of the weather, or by varying production operations. If this method of reproducing factory odors for laboratory study proves successful, it should speed up pilot plant work by 500 percent.

Controlling Odors With Stacks

Studies have also been carried out on the use of stacks as an odor control measure, to dilute odorous discharges below the odor threshold before they diffuse to ground level.

These studies have consisted of routine reviews of the literature on diffusion of stack discharges, and the use of smoke bomb traces to determine the effects of buildings on air current paths at various heights.

Development work such as has been described has resulted in the installation of considerable plant equipment, as can be seen by a review of odor control installations made by Procter & Gamble since the war.

The following tabulation indicates the major installations for elimination of odors that the company has made since 1945, or is currently constructing.

Type of Odor Elimination Installation

Location State	High Volume Venturi Scrubber	Odor Furnace	Dispersal Stack	Water Treatment
California	2		2	
Illinois		1		
Kansas	2		1	
Maryland	1		1	
Massachusetts	1		1	
Missouri	1		1	
New York		1		
Ohio	2		2	
Texas		2		1
Totals	9	4	8	1

The above installations represent a capital expenditure of more than $900,000, and an operating cost of over $400,000 a year. These figures indicate the magnitude of the investment Procter & Gamble has made in improving community living conditions as a result of research and development work on methods of odor elimination.

Should Smoke Ordinances Exempt BRICK PLANTS?

Manufacturers Claim They Must Use High Volatile Coal to Get Proper Effect on Brick Surface

L. J. Cudbird, Director of the Smoke Abatement Branch of the Toronto Department of Property, had a problem.

He was concerned about the dense smoke created by brick manufacturing plants which, at the present time, are exempt from the municipal smoke ordinance. This exemption is based on their claim that it is necessary to hand-fire the kilns with high volatile coal.

Mr. Cudbird just couldn't see it that way, and recommended to the City Council that this industry should not enjoy exemption. Before Council repealed the exemption, it instructed Mr. Cudbird to obtain information on what other cities were doing about this problem. He turned to APCSPAA for help, and here's what happened:

The Secretariat canvassed air pollution control officials in both the United States and Canada, and from the 92 answers received, Mr. Cudbird was able to make an interesting presentation to City Council.

Good Reply From Montreal

Whether it's building brick or fire brick, the problem seems quite similar. As far as fire brick is concerned, Bernard Beaupre, Montreal Smoke Control Engineer, makes the following observations:

"The manufacture of fire brick requires a reducing atmosphere in order to retain the red color of the ferrous oxide, as a surplus of oxygen would tend to transform it to ferric oxide and yield a pale yellow brick. It seems that in Canada, all firemen will request only red brick, even if this red color is only a thin coating. They do not have any confidence in white brick, and many shipments have been refused for this sole reason.

"The fire brick factory in Montreal is not exempt from the smoke law, and the following steps have been taken by the company:

"a) three of the kilns have been converted from hand firing to stoker-firing, using a portable type stoker.

"b) the fourth kiln cannot accept stoker firing for lack of space. Smokeless coal is used for hand firing on this kiln.

"c) the company is now trying to eliminate completely what is left of the smoke by burning it at the base of the stacks with the use of an oil burner. The first results were quite satisfactory, and we believe that when the length of the flame has been adjusted and the base of the stacks properly lined with refractory brick, complete success will be realized."

More Detail

St. Louis is a large ceramic manufacturing center. The plants produce almost everything made from clay, including common brick, face brick, refractory brick and tile, sewer pipe, and other clay products. James H. Carter, Commissioner of the Division of Smoke Regulation, St. Louis, gave a most interesting report on the brick smoke problem. He stated:

"When the St. Louis ordinance prohibiting the hand firing of high volatile coal was first passed, all of these industries assured us they would have to be exempt from these provisions because high volatile coal was necessary for the firing of their product. As I recall, the main reason was they could not get the required color into their ware with low volatile fuel. (We have since wondered a great deal about the validity of this argument, as practically every one of these companies is now burning natural gas and apparently having no trouble with color.)

"Since these ceramic companies were all bad smokers, we realized the necessity of doing some work with them, looking toward the use of a fuel which would not create a smoke nuisance and still produce a satisfactory product.

"It was found that when the kilns were hand-fired they smoked badly during the 'warming up' period; that is to say, from the time the fire was first built in the cold kiln until the temperature

reached approximately 1000 deg. F. After this point, continued firing with high volatile coal seemed to produce no smoke, at least none that could be classified as objectionable. This was, of course, because all the material on the inside of the kiln had become so hot that volatiles were almost completely burned before escaping into the atmosphere.

"Accordingly, we recommended that a low volatile smokeless fuel be hand-fired until this 1000-degree point was reached. Not only did the clay people feel they could fire this kind of fuel without smoke but they found, much to their surprise, that they got the kiln up to temperature in a much shorter time than was required when they fired the high volatile coal. The saving of time on each kiln of ware more than paid the difference between the high and the low volatile coal.

"With different types of kilns and different solid fuels, it might be necessary to do a little experimental work to determine at just what kiln temperature the change-over from smokeless coal to smoky coal could be made, but I believe it will be found that after the moisture has been driven out of the ware and it has reached sufficient temperature, high volatile coal of nearly any kind can be fired without objectionable smoke."

Question Statement

As to the necessity of burning high volatile coal, a number of air pollution control officials consider this statement erroneous. J. C. Marks, Assistant Combustion Engineer, Air Pollution Control Commission, Louisville, Ky., writes:

"We have a very large brick company located here which operates seven kilns using gas. They used a solid fuel up to 1949, at which time they converted to gas, and from all indications they are operating satisfactorily."

Then there are those, such as James E. Campbell, Smoke Abatement Engineer, Charlotte, N. C., who support the brick manufacturers. He says:

"Past experience with brick kilns show definitely that they must be fired with a high volatile coal. To overcome objectionable smoke, brick kilns have been equipped with a stoker placed in each of the hand-firing eyes. These stokers will give the kiln a satisfactory long flame, which will carry the heat uniformly through the kiln."

Another Point of View

The vapors and fumes generated by the clay while "drying," and mixed with the products of combustion, are the general cause of complaints, according to Thomas H. Carey, Smoke Abatement Engineer, Chicago.

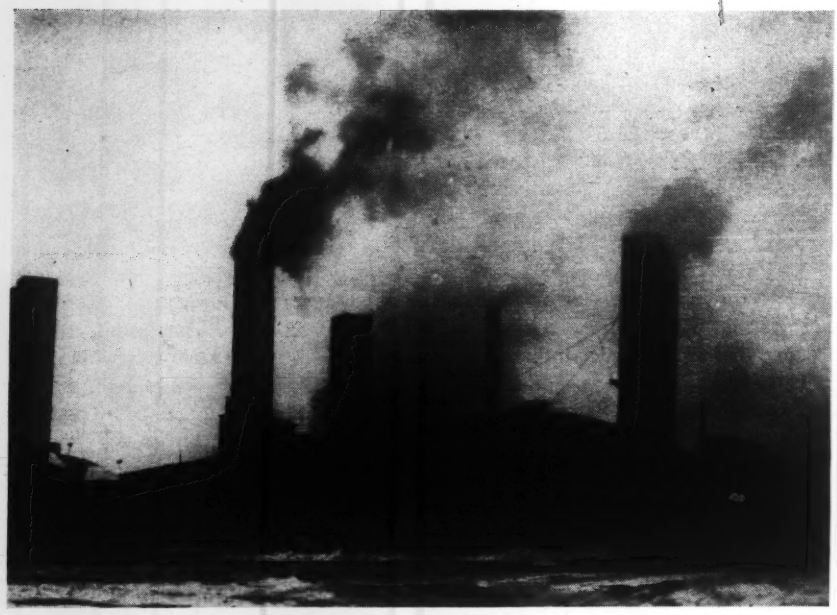
"When issuing from a kiln top," he writes, "they dissipate at low level in rather concentrated form. Two brick plants have installed collecting systems for this combination of gas, fume, and vapor, and discharge these through stacks at much higher levels.

"Because of the high temperatures encountered, and the long ducts with many inlets provided, the control of the draft is poor, and this has only partly solved the problem. However, progress is being made."

Here's F. J. McArdell's statement. He is Division Engineer, Smoke and Air Pollution Control, Syracuse:

"We had a similar problem with a pottery which contended high volatile coal was necessary, plus hand firing, to light up the periodic kilns. Notwithstanding, we insisted upon compliance with our ordinance. As a result, the pottery conducted experiments with different types of low volatile coal, and an adaptable size was found. Since then, we have had no further difficulty. This type of industry should not enjoy exemption.

Note the untidy appearance of this brick kiln and its heavy smoke emission.



Aerial filth as disgorged by an offending brick kiln.

Exceptions should not be made. The law should be enforced impartially, playing no favorites."

Green Bay Solution

Anthony F. Sidlow, Air Pollution Control Engineer, Green Bay, Wisconsin, suggests the installation of a pulverized coal burning unit with the introduction of flue gases into the combustion zone, as is now being done in one of Green Bay's lime plants. At no time is there any smoke, Mr. Sidlow asserts, "not even a No. 2 Ringelmann."

W. Lawrence Cox, Director, Air Pollution Control, Kingsport, Tenn., states:

"Plant officials experimenting with various types of stokers found that the small overfeed drop stokers proved most satisfactory. At present all kilns in operation are equipped with these stokers, using coal of about 30 per cent volatile content. Some smoke occurs during the first few hours of firing, but is normally below a No. 2 density on the Ringelmann chart."

The brick industry has some old-fashioned ideas about the necessity of making smoke to color the brick, in the opinion of William G. Christy, Director of the New York Bureau of Smoke Control.

"It is possible," he says, "to fire with stokers, with natural gas, and with oil. Most of the newer fire brick plants are equipped with tunnel kilns fired either with oil or natural gas."

The law in Chattanooga, Tenn., requires mechanical firing in all industrial furnaces, and that has been made very clear to the local plants, according to Emerson P. Poste, Director of the Bureau of Air Pollution and Boiler Inspection.

He's Thankful

Harry C. Ballman, Smoke Regulation Engineer, Columbus, O., writes:

"Presently I am quite thankful to say that I do not have any brick kiln problems in Columbus. I did, however, have this problem in other cities such as Richmond, Va., and believe me, it is a very hard one to handle because of the terrific investment involved in bringing the average hand-fired kiln up to date.

"There is no reason why they should not continue to use high volatile coal in firing their kilns; and it is also not necessary for them to make unnecessary smoke. The installation of specially designed stokers for the specific use of brick kilns has been proved a feasible solution in many locations."

Here's H. K. Kugel's comment. He is Chief Engineer, Smoke and Boiler Inspection, Washington, D. C.:

"We have three brick yards within the city limits, one fired with oil, the other two with coal. The coal-fired jobs use a low volatile coal and manage to do an acceptable job under normal conditions.

"Recently one got in some high volatile coal and we immediately started getting violations. These stopped as soon as they got back on their regular low volatile coal. I see no reason why they should be exempted from a smoke ordinance."

Legal Opinion

Very many interesting opinions were given in answer to the questionnaire sent out by the Secretariat—too many to list in this article. The Editor, however, wishes to express his gratitude to all who answered the request, and trusts he will receive the same enthusiastic response to other future queries.

The article closes with an excerpt from John A. Cowing's reply. He is a member of the Smoke Abatement Department of East Cleveland, O., and he said the brick kiln problem reminded him of the case of McCarty vs. Natural Carbonic Gas Company, 189 N. Y. 40, 81 N. E. 549.

The court in this case said:

"The defendant's business is lawful and not a nuisance in fact—some smoke is generally created by the nature and ordinary use of land near a village or city, and, while this may sometimes be annoying to neighbors, it is part of the price paid for living where there are neighbors.

"But when the smoke is unusual and excessive as to materially interfere with the ordinary comfort of human existence, the trier of facts, taking into account all the circumstances, such as public utility, locality, immediate surroundings and the like, may find the use unreasonable. . . . It is better . . . that profit should be somewhat reduced than to compel a householder to abandon his home."

"The Air Pollution & Smoke Prevention Association of America is a very wonderful organization, non-profit, which has done and is doing a tremendous job in clearing our cities of smoke and dust. They deserve widespread support."—Excerpt from a letter written by Donald J. Howard, Executive Secretary, Pittsburgh Chamber of Commerce, in answer to a request for information.

Entitled "Portrait of an English County Town," this view of Hereford, photographed by Aerofilms, Ltd., shows a heavy pall of smoke over this historical city.

POWER AND WASTE IN THEIR SOCIAL SETTING

Condensation of an address given by Dr. J. Bronowski as the Second Des Voeux Memorial Lecture before the 1951 Blackpool Conference of the National Smoke Abatement Society, Great Britain. The Proceedings of the Conference may be obtained for $1.25 by writing to the Society's headquarters at Chandos House, Buckingham Gate, London S. W. 1, England.

There are two ways to end the nuisance of smoke. One is to give up this industrial work and life, and turn to something else: something simpler and greener. The other is to hold to our industrial life and to get rid of the smoke as something which has no business there.

You and I and every man-jack in Britain, 50,000,000 of us, live by industry. We are a country built upon a bottom of industry; and to withdraw from industry is, as a people, to give up our life.

There are those who see in smoke only the symbol of industry, and whose attack on one is an attack on the whole basis of our life these last 200 years. They would like somehow to turn us into a farming country, and to see London all fields again.

I must make it clear that I am not of their party and I hope you are not. There are farming countries today and there should be; but Britain cannot be one. I should not like to see her waste herself. I should like to see London green, but I should not like to see it all fields again.

Our aim is to make a better thing of industry. There have been many blots on industry: child labor and intolerable hours and dusts and poisons and lockouts. Some are now wiped clean and some remain; factory dirt, back-to-backs, squalor and decay. We should be ashamed of these, and more, we should make others ashamed. But industry itself is nothing to be ashamed of.

An Early Revolution

When the Elizabethans sailed out into the Atlantic, industry was already the staple they carried and the muscle to their adventure. The Elizabethan Age was our first industrial revolution, and this deserves better than to be forgotten in the glow from breakfast beer and piracy. London grew rich enough to build the theatre Shakespeare wrote for, not by farming but by trade in her manufactures.

But I do not need to skirmish with any romantic about the details of Elizabethan coke and glass making. I can step forward a hundred years to another age restless with imagination and movement: the age when John Evelyn persuaded Charles II to give his name to the new Royal Society, much as he persuaded him to look at the work of an unknown carver called Grinling Gibbons.

And in the society where Christopher Wren jostled with Newton, and the poet Dryden with Robert Hooke, what were the problems which great men thought worthy of their excited study? They were navigation and metallurgy, gunnery and dyestuffs, and my own interests which I am proud to trace back to that age—mining and statistics.

Step forward another hundred years: we are at 1760 and the Industrial Revolution. It began hard and bleak; but Blake and Wordsworth were born at that moment, and England doubled her people in 70 years, and put them into leather shoes and clean iron beds and gave them white bread.

I am tired of having the Industrial Revolution maligned as if it had put out the sun. Our health and our vigor and the delight in action which is still our pride were made then: and the men who made them were not money grubbers, they were great men and I am angry when I hear them slighted.

Joseph Priestley and Baskerville and Arkwright, Wedgwood and Watt and their friend John Wilkinson, William Small who taught Jefferson and Count Rumford who hated him—they are the match of any generation that walked the earth with its head high.

Men Make History

In these 150 years since Matthew Bolton died, Birmingham has swept round and over the neat factory which he took

to Soho because work there was orderly and spacious. Etruria is now as dark as the rest of the potteries, from whose squalid cottage industry Wedgwood moved deliberately.

These men were more clear-sighted than those who came after them. They knew that the things they were trying to do, precision work and glazing china and the fine processes of industry, are not a grimy hugger-mugger and do not thrive in it.

To them from the outset dirt and crowding were forms of waste, and they would have liked to scrawl over them as one of them did over other pieces of bad workmanship: "This won't do for Jos. Wedgwood."

They were the pioneers of efficient industry. They were single-minded men; to them waste was waste, whether it was waste of materials or human skill. They did not draw a line between factory problems and human problems; and one reason was that they brought to them both a single method—the method of research. They had faith in science.

And it was part of that faith, which Adam Smith underlined in *The Wealth of Nations,* that industry will not do well unless it is run well. When William Murdock put out the torches in the Soho factory and invented gas light for it, when Benjamin Franklin wrote to Boulton that the right thing to do with smoke is to burn it, they did not pause to admire themselves as laurelled benefactors of mankind.

Human Values

Our world has not stopped growing since 1760, but in this century it has begun to grow very skew for us. It has been discouraging to see the chemistry of Roebuck and Perkins drift to Germany, the looms go to Japan, the furnaces to Lorraine, and all the steel and metal work of the Midlands go to the United States.

We have suffered the fate of all good teachers, that our pupils have turned out very bright. In our plight we find ourselves advised by two kinds of Jeremiahs. One advises to go back to the land, and points out owlishly that this would cure the nuisance of smoke.

The other prophets of despair propose the opposite. We are now behind in the industrial race, they say, and therefore we cannot afford to do anything but stumble on; we must not, as it were, stop even to tie our shoe laces. We cannot afford to clean and tidy our works and, what is more important, our processes.

We are far too poor, they say, to modernize our plant, or to invest our talent in new research. Let us just sweat along with what stately Edwardian equipment we have; and when it does at last fall to pieces (though they made it pretty indestructible) why, we can always buy the latest machine from the Germans or the Americans.

Method Not Technique

Those who speak like this think that our success, in spinning or smelting or making dyes, depended each time on some trick of the trade; and now others have filched these secrets from us.

Wurts scoots to Cleveland.

But this is quite mistaken. What we taught others was method, what we taught them was efficiency and attack, and the techniques are only a by-product of these. Believe me, where the industries of our rivals are ahead of us, it is not because we have taught them to use our techniques, but because we have taught them something more important, to strive for better techniques.

We were the pioneers who showed that invention and efficiency will master any problem; we taught them and, yes, we were willing to learn them too, from Huguenots and French royalist and German liberal refugees.

And now that our success has spread to the corners of the world, are we asked to unlearn the lesson? Are we really going to be content to snort along in an elderly way in the rear of the field, and protest that we have not the time to change our style or our spikes?

This country has a number of endearing and maddening habits. I count among them a certain strain which inclines us to treat any elderly piece of equipment much like a pensioned gun-dog whom it would be disgraceful to grudge feed and house room.

I hope that we shall always be able to afford the dog, but I will not hear a word in favor of antideluvian machines; and least of all do they seem lovable to me because they smoke as fiercely as their owners. The owner may not afford a new machine; the nation cannot afford the old one.

I am speaking here to the small owner as urgently as to the large—yes, and to the smallest of all, the house owner. For he has a piece of equipment on which he dotes, which is most prodigal of energy and health.

I mean, of course, the old-fashioned grate, which as a machine for burning coal was out of date before Benjamin Franklin died in 1790. Our grates still puff out so much benzpyrene that it could give every laboratory white mouse in the country cancer.

We still darken the sun with smoke, and then choke the etiolated plants. And we still waste our national income each year, which is as much as we have recently spent building new houses.

Don't Ask Uncle

I am in no doubt at all that this country can hold its place among the leaders of world industry. But not by blowing 16 or 17 cwt. of energy in every ton of coal up the flue; and not by scattering sulfur on the wind and begging an allocation from Washington.

We talk grandly of harnessing the tides on the Severn at a cost of a hundred million pounds; but half that sum would modernize enough house and factory grates to save 20,000,000 tons of coal a year. And there would still be quite a margin left for the next generation to use.

John Evelyn fumed against the sulfur in the air 300 years ago, because it withers life. A hundred years later, Roebuck and Keir built our chemical industry on sulfuric acid. Since then the use of sulfuric acid has become as precise a measure of a nation's strength as the figures of horse power or real income.

In the last 50 years, the world use of acid has risen seven-fold. What do we do? We complain that we are short of sulfuric acid for our needs, which do not quite reach 2,000,000 tons a year. Yet every year we blow up our chimneys in this country enough sulfur to make at least 7,000,000 tons of acid—four times our own needs, and more than a quarter of the needs of the whole world.

Modernizing Our Industries

For us in this country, and indeed in Europe, the task of modernizing our industries is critical. We do not have the resources of North America; but this does not mean to me that we do not have their industrial potential. It is their agricultural sufficiency that we lack. We can and we must match their industrial strength.

The familiar raw materials are becoming scarce. Zinc and copper, rubber and wool—once they were indispensable, but now we wonder whether we must long go on paying famine prices for them. Why? We know enough chemistry to build up for ourselves molecules which have almost any property we need.

The basic industries must in fact more and more turn to the task of taking these custom-built molecules out of the laboratory and manufacturing them for industry.

But here I think we have not taken a bold enough lead; for example, we have left the pioneer work in polymers to the oil chemists, and have neglected our own great resource of coal as a basic chemical.

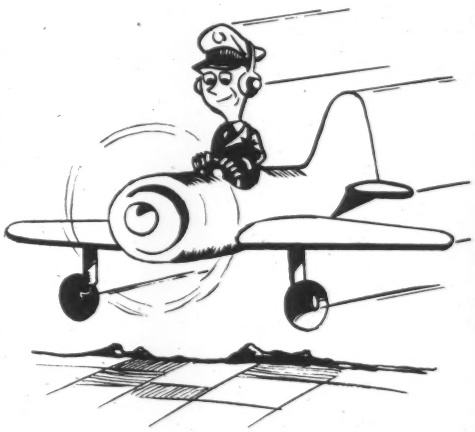
Why, if the oil industry had not had the itch for research, it would still be using its product as Rockefeller did—to burn in kerosene lamps.

Our use of coal and even of oil is by no means running away with the earth's stock. Our use of water power is only a few per cent of that resource, which in Europe alone offers us 75,000,000 horse power; and this is a renewable resource.

And behind these stand a dozen more remote but wholly practical sources of energy, if we ever run short enough to need them. The world is not likely to run out of energy, so long as it has man's inventiveness at its command.

We have a great head of energy here, now, waiting to be tapped; and to make the new industrial revival I have preached, we must learn to use it at once. It is the wealth of energy we waste, day in and day out. It is the 20 cwt. of energy that is there, ideally, in every ton of coal—and the 17 of these ideal cwt. which we throw away.

It is the smoke up the chimney and the soot on the boiler, the steam that goes to waste in the cooling towers and the smell around the gas works, and a



Bill Stewart coming in on a wing and a prayer—to Cleveland!

million inefficient appliances in every factory and home.

Machines Which Think

Let me give you one example, how the new industries of Britain will have to make the most of our resources of power. It is the machine which thinks—at least, it does what its operator calls thinking. That is, it switches itself on and (more important) off, and adjusts itself to its load.

This is not a distant fancy—we have begun to use these machines, and we must use them if we are to make the most of our energy and our materials. I will quote what I have written elsewhere, because it puts both the method and the lesson succinctly:

"One means which new factories will come to use is the automatic control of their own processes. We find it easier still to have energy leaking from every belt and flywheel than to turn a dozen switches on and off in a sequence of operations.

"Machines to us are still all thumbs and muscle; we are not at home with the thinking machine. But in fact, the machine which reads its own gauges and throws its own switches is as great as the human brain; and we shall have it with us soon to stay.

"There is a moral in this likeness. The primitive processes of nature are also lavish in their waste of energy; for example, the action of leaf chlorophyll in making sugar from the air, on which all life depends, uses only one per cent of the sunlight on the leaf. But as the living material becomes more highly organized it also becomes more sparing; until the muscle is a far more efficient user of energy than any machine.

"The brain does not show so obvious a return of work for the energy put into it as does the muscle. Yet the human system has found that it pays to supply each cell in the brain with about three times as much energy as the other body cells. Indeed, the body invests a quarter of all the energy it gets in the brain. The best use of energy is in planning its use."

The Energy We Waste

The largest store of energy which this country possesses is the energy it wastes. Here the cure is the modernized plant, the revision of layout and sequences in all industrial operations and, above all, new processes. And for these, we have a source as rich as the energy we throw away: the skill of ten generations of men bred to industry.

I do not fear the rivalry of any nation if we give ourselves the chance to match them in invention.

What is the general shape of the industries towards which we should therefore move? Plainly, they should depend more on technical skill than on raw materials.

Today we must learn the lesson that we taught to the Swiss, and to turn to industries which hinge on skill. There are such industries ready for us, just over the horizon: in alloys and aircraft and other light construction; in chemicals and antibiotics, in the range of new materials built atom by atom to do special jobs, and in the use of coal itself as a chemical.

From Lab to Factory

Can we translate genius from the laboratory to the factory? There, let us confess it, lies our weakness. We are short of the technologists who are expert in making science practical.

Indeed, we are not always sure what a technologist is, and we go on thinking that he can be trained in a technical school with men who are learning a much simpler skill in one industry.

The step from the glassware on the bench to the full-scale plant, the transition through the pilot plant, which is that special province of the technologist, that we have yet to learn.

We have to learn it today in one field most of all: the field of atomic energy. J. J. Thomson and Rutherford created that, and more than most nations we shall want to turn ten years from now towards the massive power in a small space which it can yield.

We, the discoverers, can command it if we bring to its problems the fundamental science and the skill in technology which together are the brain and the nerves of a modern nation.

I warned you that I should wander from smoke, and I have done so. But in doing this I hope that I have shown you that the problem of smoke fits squarely into the larger problem of our industrial future which should be troubling us.

Smoke is a nuisance, and every discovery man makes sets him at the same time a nuisance problem. In 20 years we shall have the nuisance of atomic wastes, and I hope that we shall have sturdy and indignant pioneers to combat them.

But smoke is also more than a nuisance: it is a symbol of untapped resources which we have ready to hand, in the waste of power, of materials, of industrial skill and scientific discovery.

I believe that our life as a great nation depends on reaching down into these resources. If we put an end to the waste of them all at once, you and I may think our task well done. And we shall be just in time to turn ourselves into the National Society for the Abatement of Atomic Wastes.

LAST TIME AROUND

Individual membership dues for the year 1951-52 were payable prior to May 1, 1951. Most of them came in at that time, or shortly after. However, there are still a number of delinquents who have been billed during the past month.

This is a typical issue of AIR REPAIR these delinquents have received. Printing and engraving costs of the magazine alone amount to more than $1 a copy. In addition, members receive free of charge a copy of the Annual Proceedings and the Minutes of the Annual Meeting. The Proceedings are sold to non-members for $7.50.

Charges for the magazine and the Proceedings come to $11.50, $1.50 more than the annual individual dues. That's a pretty large package to receive for $10. In addition, there are reprints and other services from which members benefit during the year.

Membership regulations are going to be stiffened. But in this first revitalized year it was the intention of the Board to show the members what was being accomplished.

Only those who are currently paid up will receive AIR REPAIR, and the rest of the Association's publications and printed matter, from now on.

SECOND NATIONAL AIR POLLUTION SYMPOSIUM

The second national air pollution symposium will be held at the Huntington Hotel, Pasadena, Calif., on May 5 and 6. Several hundred scientists, engineers, technical workers and executives interested in air pollution affecting industrial communities are expected to attend.

Management's views on air pollution will be introduced. Dr. A. M. Zarem, chairman of the executive committee, said:

"We hope this participation will assist in a better understanding of the necessary contributions of industry and science toward the achievement of tolerable limits of air contamination from the standpoint of community health."

The program will cover general topics of new techniques in sampling, analysis, and instrumentation, fundamental chemistry and physics of the atmosphere, the contribution of internal combustion engines and biological aspects of atmospheric contamination.

Among the speakers and their papers are the following:

Dr. A. O. Beckman, president of Beckman Instruments, Pasadena: "Our Knowledge of Atmospheric Pollutants: Status Report."

Dr. Joseph Kaplan, Department of Physics, University of California at Los Angeles, who will preside over the reading of four papers related to the session topic "Fundamental Chemistry and Physics of the Atmosphere."

Dr. W. N. Lacey, dean of graduate studies at California Institute of Technology, will preside at a session devoted to "Combustion as a Contributor to Air Pollution."

Dr. Rutherford T. Johnstone of Los Angeles, member of the American Medical Association Committee on Air Pollution, will lead the final afternoon session on "Biological Aspects of Air Pollution."

The symposium will be held under the sponsorship of Stanford Research Institute in cooperation with the California Institute of Technology, University of California at Los Angeles, and the University of Southern California. The sessions will follow the general pattern of the first symposium held under the same auspices three years ago.

The papers given at that time have been assembled in book form and may be purchased for $2.50 by application to Stanford Research Institute, 612 Flower Street, Los Angeles 14, Calif.

THEY SMELL GOOD.—This is the six-man wax-testing committee of the Bayonne refinery of Esso Standard Oil Company. By smelling shavings taken from every production batch of wax, these experts guarantee its odor-free purity. Paraffine, which is used to coat milk cartons, paper cups, and thousands of food packages, has an affinity for almost any odor. Intricate machines test the wax for tensile strength, hardness, oil content, and melting point. But no machine can touch the human nose for one of the most important tests of all. The committee members are, left to right, Joseph Tobis, Stanley Chesney, William Kopacz, John Nemec, George Syme, and Milton Hays.

SIX NOSES GUARD PARAFFINE PURITY

These Standard Oil Smellers Are Jolly Good Fellers

Until scientists come up with something better than the human nose, a few veteran oil men will guard the purity of the wax that coats our milk cartons, bread wrappers, and a thousand other food containers.

At Esso Standard Oil Company's Bayonne, N. J., refinery, one of the world's largest wax producers, six highly skilled laboratory workers form a novel wax-testing committee.

Their job is to check each day's production of paraffine by smelling samples of every batch turned out by the plant. The keen-nosed half-dozen are part of the human element of a highly mechanized industry in a mechanized age.

Mechanical eyes and ears are common—television combines them—but a robot nose is still a dream of the future.

No Odors

Because paraffine is used in packages for butter and other foodstuffs which have an affinity for odors, it must be odor-free. And because paraffine itself has that affinity, every batch must be tested to make sure it's fit company for dairy products, cereals, and countless other foods packed in waxed paper or cartons.

Wax turns up in many consumer items. You'll find it in shoe polish, crayons, drugs, cosmetics, textiles, electrical insulation, matches, and, of course, in candles.

But more than half of all wax goes into food containers, waxed paper and cups.

Wax smelling is a science that only an experienced nose knows.

No Smoking

To "train" for their daily sniffing sessions, the sharp-nosed six must abstain from smoking for at least an hour before the tests. They shun onions and garlic like the plague. Head colds keep even the sharpest noses figuratively on the bench, and a hay fever victim can never aspire to a wax-smelling career.

At the zero hour the sextet gather in a hopital-clean laboratory cell. They wash their hands carefully in odorless soap, and spread out clean sheets of parchment paper. Into them they whittle fine shavings of wax from small sample slabs.

With a sweeping motion that befits a king's favorite wine taster, Esso's wax testers bury six noses deep in the shavings. In one deep breath each takes the measure of the sample at hand.

Court of Last Appeal

Each man then judges his samples individually and the results are compared. Conflicts are submitted to the arbitration of the committee chairman, a white-thatched laboratory expert with more than 40 years' experience. Any sample not passing with flying colors sentences that particular batch to more refining before it's allowed within hailing distance of food stuffs.

While watching their diets and training routines, the six smellers must guard against overworking their razor-keen noses. Par for the course is just six sniffs. After six, "olfactory fatigue" sets in and the nose needs a rest!

Long before the paraffine winds up in a food package or atop a jar of home-made jelly, it gets mechanical tests as well. Complex machines check it for oil content, hardness, melting point, and tensile strength.

But first it must win by a nose!

RIGHT ENGINE, WRONG TRAIN

In the February issue of AIR REPAIR George B. Curtis and L. L. Rogers were identified as being employed by the Pennsylvania Railroad. Both, as a matter of fact, are road foremen of engines for the Richmond, Fredericksburg & Potomac Railroad.

The initials RF&PRR threw your Editor, and so he humbly begs the pardon of Messrs. Curtis and Rogers, as well as the RF&P and the PRR railroads, defending himself with the following quatrain:

As we approach life's gray December
These in the main are our regrets,
When we're right no one remembers,
When we're wrong no one forgets.

MAKES ENGLISH VISIT

G. V. Williamson, of the Union Electric Company of Missouri, St. Louis, who was appointed chairman of the Nominating Committee last September, tendered his resignation as chairman because he was drafted by the Mutual Security Agency to make an industrial survey of Great Britain.

G. V. Williamson

Within 48 hours of receiving the news, Gerry was on his way. While in London, he visited Arnold Marsh, Executive Secretary of the National Smoke Abatement Society, and discussed air pollution problems with him.

President John L. Hodges filled the committee vacancy by appointing Robert L. Walker, Jr., Nashville, Tenn., Air Pollution Control official.

ANNIVERSARY.—It's been just fourteen months ago that John J. Kane, Chairman of the Allegheny County Board of Commissioners, left, handed Henry F. Hebley a check for a sustaining membership in APCSPAA. This is the first, and so far the only, case where a municipality supported our organization to this degree. When can we expect the next? The Allegheny County Commissioners took a much longer chance then than anyone would at this time. We've gone places in a year—and, in the words of the late Al Jolson, "You ain't seen nothin' yet!"

WELCOME!

The following new members have been received between October 1, 1951 and March 1, 1952:

Sustaining Members: Westinghouse Electric Corporation, Pittsburgh, Pa. Representative, R. J. Weber, Assistant, Central District. Tennessee Products & Chemical Corporation, Nashville, Tenn. Representative, Carl McFarlin, Jr., Vice President.

Company Members: Hilton-Davis Chemical Company, Cincinnati, O. Representative, Chester H. Allen, Director of Research. Kaiser Aluminum & Chemical Corporation, Spokane, Wash. Representative, Dr. Dana W. Smith. Rust Engineering Company, Pittsburgh, Pa. Representative, J. Paul Scheetz, Vice President. American Air Filter Company, Louisville, Ky. Hotels Statler Company. Representative, Thomas F. Troy. Mathieson Chemical Company. Representative, Dr. N. O. Stein.

Individual Members: Edwin L. Alpaugh, Inspector, Bureau of Smoke Inspection, Cincinnati, O. E. J. Anglin, Chairman, Air Pollution Committee, Steubenville, O. H. A. Belyea, Chief Industrial Hygiene Engineer, Division of Industrial Hygiene, Ontario Department of Health, Toronto, Canada.

F. F. Borries, Stoker Specialist, Westinghouse Electric Corporation, Cincinnati, O. William R. Bradley, Chief Industrial Hygienist, American Cyanamid Company, New York, N. Y. Dr. Natale Colosi, Professor of Bacteriology and Public Health, Wagner College, Staten Island, N. Y.

W. Lawrence Cox, Director, Air Pollution Control District, Kingsport, Tenn. John J. Herwick, Smoke Specialist, Westinghouse Electric Corporation, Pittsburgh, Pa. William J. Hogg, Air Pollution and Waste Control Engineer, Naugatuck Chemicals Division of Dominion Rubber Company, Elmira, Ontario, Canada.

Herbert C. Johnson, Assistant Smoke Regulation Engineer, Columbus, O. Harold S. Linderman, Stoker Supervisor, Westinghouse Electric Corporation, Pittsburgh, Pa. George E. Marble, Industrial Engineering Department, Michigan Consolidated Gas Company, Detroit, Mich.

John C. Marks, Assistant Air Pollution Control Engineer, Louisville, Ky. Fred W. Mayer, Manager of Industrial Department, Chamber of Commerce, Perth Amboy, N. J. Donald J. Mosshart, Chief Smoke Regulation Engineer, South Philadelphia, Pa. K. C. Richmond, Publisher, *Coal-Heat*, Chicago, Ill.

E. C. Stone, Manager, Engineering and Service Department, Westinghouse Electric Corporation, South Philadelphia, Pa. Charles Taddonio, Sales Engineer, American Air Filter Company, Pittsburgh. Pa. H. S. Wells, Staff Plant Engineer, Chrysler Corporation, Highland Park, Mich. Bernard Wich, Village Engineer, Herkimer, N. Y. Dow Wynn, Manager, Chamber of Commerce, Houston, Tex. V. L. Kelley, Jr., and John S. Fletcher, Tennessee Products & Chemical Corporation, Chattanooga, Tenn.

HOW THE SUPERINTENDENTS' COMMITTEE OF GREATER CINCINNATI REDUCES SOME VIOLATIONS

by T. J. WELLS
Supervisor of Locomotive Operation
Cincinnati Terminal, Cincinnati

The railroads in the Cincinnati Terminals have learned from experience to avoid publicity when improvements in methods of equipping and handling steam locomotives and stationary plants have brought better smoke control.

Better fuel on one road, or a more efficient plant for steaming up engines on another, when brought to the attention of the general public, invariably result in a demand for the others to follow suit immediately, regardless of cost.

There is less smoke from the coal-burning locomotives in the Cincinnati Terminals than any comparable area in the country. This is a challenging statement. Close records are kept, compiled from several sources, but the only true gauge of smoke is the amount seen above the right-of-way, and there is little smoke visible around the railroads here.

Long History

Demands for smoke control began in Cincinnati shortly after 1900, and in 1913 the city passed a law with teeth. The Cincinnati Superintendents Committee appointed a joint Supervisor of Locomotive Operation, with an adequate staff, to cope with the problem for all the railroads.

Try to visualize the situation he faced! The engines were small, no superheaters, no arches, no smoke abatement devices, leaked badly, poor blowers, and in general poor mechanical condition.

G. H. Funk, the first supervisor, wrote the general managers and superintendents in December, 1913, that in addition to the above difficulties, he found the supervision and employees very indifferent.

1926 Was Milestone

In 1914 Cincinnati began to prosecute smoke violations in the courts, and until 1926 the files reveal a continuous fight between the city, the railroads, and the brotherhoods. Enginemen were jailed, fined, suspended, dismissed, and there was not much improvement.

The general managers and superintendents met with the mayor, the city manager, and the chief smoke inspector in 1926, and worked out an agreement placing the responsibility in the hands of the railroads. Smoke violations observed by the city inspectors would be sent to the supervisor of locomotive operation, who would handle matters with each road, for investigation and discipline under the practice current on that road. A satisfactory reply would be rendered to the chief city inspector. The railroads engaged themselves to reduce the violations below two percent of the observations made by the city inspectors.

Plan Works

The new plan worked, and this may be fairly said to be the birth of real smoke control in the Cincinnati Terminals. The management made it mandatory that every supervisor make it an important part of his work to teach his own men to handle engines without objectionable smoke.

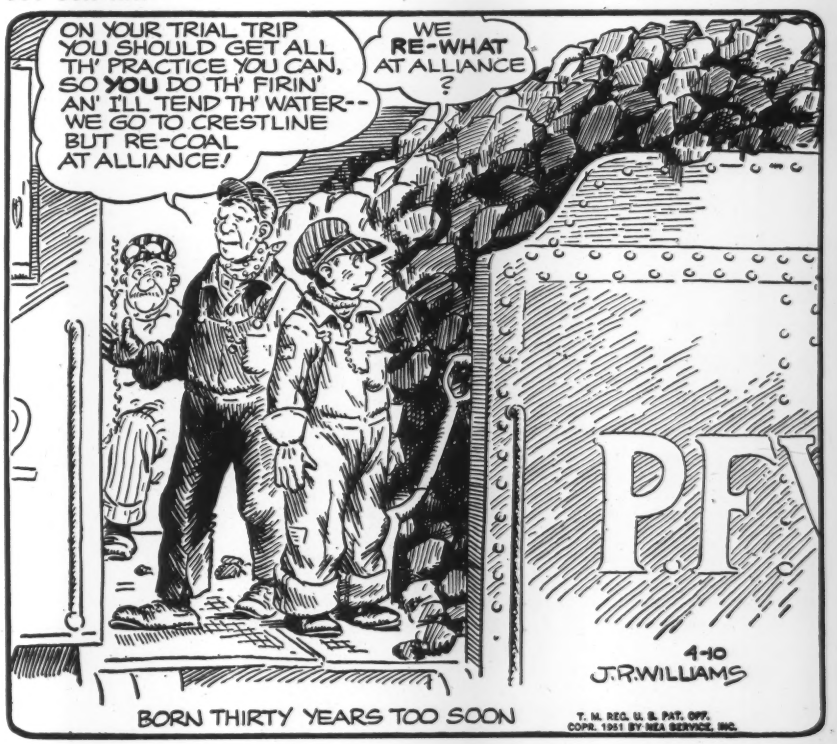
Cincinnati Terminals is the only railroad center that has a joint supervisor of locomotive operation, reporting to the superintendents of all the roads, through the chairman elected from the superintendents. This gives the supervisor the solid backing of the entire management, and enables him to point out plainly what any road needs to improve its record.

All violations pass through this office to the particular supervisor responsible, and the handling is returned to him for disposition. This allows him to suggest to the superintendents conditions that cause smoke violations, and remedial action. It is seldom necessary to appeal to the superintendents, as this office receives the confident cooperation of all the staff officers on every railroad.

Discipline Administered

There are a number of cities and towns on both banks of the Ohio River, and some of them passed smoke ordinances.

OUT OUR WAY — BY J. R. WILLIAMS


ON YOUR TRIAL TRIP YOU SHOULD GET ALL TH' PRACTICE YOU CAN, SO YOU DO TH' FIRIN' AN' I'LL TEND TH' WATER-- WE GO TO CRESTLINE BUT RE-COAL AT ALLIANCE!
WE RE-WHAT AT ALLIANCE ?
P.F.
4-10
J.R.WILLIAMS
BORN THIRTY YEARS TOO SOON
T. M. REG. U. S. PAT. OFF.
COPR. 1951 BY NEA SERVICE, INC.

Others tabled legislation at the request of the railroads, allowing them to clean up the smoke through their own efforts.

All reports from chiefs of police, mayors, councilmen, or individuals receive serious attention, and disposition reports are sent back to these persons. Today any excessive smoke reported by anyone anywhere in the Terminals is promptly investigated, and proper discipline administered.

The introduction of bigger and better engines helped abate smoke, as did modern engine houses, and improved methods of firing engines were worked out. Firemen and steamkeepers had smoke control drilled into them from their first day in service.

The supervisor of locomotive operation's department has a complexity of duties, riding with firemen, particularly new men, trying to instill in them the importance of smokeless firing. We teach the horseshoe bank, convinced it is the only solution to smoke control on steam engines in yard and transfer service.

Horseshoe Fires

The saving in coal and water is stressed, as the blower and smoke consumers can be eased off, and the engine will be ready to handle a tonnage train without trying to build up the fire at a moment's notice.

Fires are checked on ready tracks and at receiving tracks. Horseshoe fires are set out for all crews, and they are not allowed to shake them, but are taught to apply blower and consumer, and coke the horseshoe, to allow for starving the fires getting trains out of the Terminals.

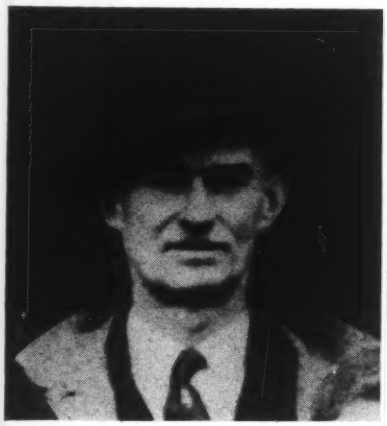
Inbound engines are checked, to see they have plenty of fire, steam, and water, when crews leave them for engine house forces. It is believed poor fires on ready tracks and receiving tracks are the greatest cause of violations, and should be charged to the person leaving the engine, and not to the man who is taking over.

Locomotives are constantly checked for defects that contribute to smoke, and reported to the proper officer for correction. Good engines discredit alibis, but a poor engine discourages the crew's belief that the supervision is sincerely helping abate smoke. The mechanical departments maintain the locomotives in excellent condition, and immediately repair defects reported.

Close Check Kept

Charles W. Gruber, Chief Smoke Inspector of Cincinnati and Past President of AP&SPAA, heads an efficient staff of inspectors, with stationary and locomotive engineers among them, who keep a close check on the railroads.

Violations are telephoned to the supervisor's office, and the proper officer is quickly contacted for prompt action. The city's inspectors are acquainted with many of the railroads, and are often called over by men who have difficulties, or think they may have made too much smoke. They are strict, but just, and have the respect and confidence of the railroads.



T. J. Wells

Quarterly meetings are held between the Superintendent's Committee and the chief city smoke inspector and his staff, and the railroad smoke record is thoroughly discussed. No one is embarrassed by any harsh criticism, but the record itself, by comparison between railroads, forcibly points out where efforts for improvement must be centered.

An average of 35 officers attend these meetings, and it is believed they are of tremendous help in pooling knowledge for smoke control. Since everybody is asked to express his opinions frankly, the railroads and the city have a better understanding of each other's problems. A featured speaker is usually included on the program, and a wide range of related topics brings new light to the smoke program.

Howison Active

The Smoke Abatement League of Hamilton County plays an important role in the Terminals, as Charles N. Howison, its Executive Secretary and National Chairman of Cleaner Air Week, is quick to bring laxity to the supervisor's attention. His activities are county-wide, and often go into neighboring territory, in his efforts to bring about a cleaner place to live.

Mr. Howison's efforts before councils, civic organizations, parent-teacher groups, the press, radio, and other mediums of contact with the public, keep the railroads alert to minimize complaint.

His reports are processed the same as a city report, the complainants are visited, and the railroad operations are checked, to spot the offenders, and try to relieve the nuisance. Disposition reply is then given to the League.

Excellent Smoke Record

For some years Mr. Gruber has asked the railroads to reduce their violation ratio to one percent of the observations made. One minute in one hour of No. 3 Ringelmann smoke is a violation, and this has been a hard goal to attain. Recently the railroads have made a determined effort to cut the smoke violations to a minimum, and finished 1951 with an 0.6 percent average.

Contrary to casual impression, the 50 percent dieselization of the Terminals make this average harder to earn, as the steam power is scattered over the whole Terminal, and a single violation counts heavily against a road. The smoke record is based on steam operation only, with no credit for other types of power observed.

Believing a bold attack is the best defense, everyone responsible for operation or maintenance of steam engines is giving his best efforts to smoke control. We are asking for a smokeless performance at all times. No refuge is sought for the allowances under the law, but an attempt to keep clear stacks. Cincinnati's ordinance allows six minutes in firing up or cleaning a fire, but it wasn't necessary to explain a single violation in 1951 under this immunity.

There are smoke violations, and there are complaints from the public through the various sources mentioned. New men, defects that show up after engines are dispatched, and the occasional slip-up of

the best men keep us working hard to maintain and improve the smoke record in the Cincinnati Terminals. The fact remains that with the help of all the men on the railroads, a proud record of smoke control has been established.

CHICAGO CRACKS DOWN

Chicago got tough with its smoke violators when, late in January, a smoke violation fine of $600 and $30 costs—the largest of its kind this winter—was assessed against an owner of two apartment buildings who had been put on "good behavior" two months ago.

The fine was imposed by Municipal Judge Jay A. Schiller on Alex Pielet, a junk yard operator, according to the Chicago *Tribune*. City inspectors testified he had failed to heed the court's warning about smoke violations.

He had already been found guilty in November of three violations, but the maximum fines of $200 for each offense were held in abeyance pending his intentions to conform with city regulations.

Another Fine

Judge Casimir V. Cwiklinski fined Fred Nelson, operator of the Victory Auto Wreckers, $200 and $10 costs for having burned automobiles to obtain metal in the recent scrap drive.

Nelson contended that federal authorities told scrap dealers in effect to overlook local laws in burning upholstery and rubber from old cars.

Sam Radner, Assistant City Smoke Abatement Engineer, took issue with Nelson on his remark. Judge Cwiklinski commented:

"The federal government has no right to ask anyone to violate local laws." Two other fines, each of $50 and $10 costs, were imposed on other violators.

WHO'S WHO IN AIR PURIFICATION

When battle wagons were given their shakedown cruises 52 years ago, it was felt they could not meet their speed requirements unless continuous clouds of the blackest smoke billowed from their funnels.

Smoke control in those days had few friends and fewer advocates.

Ask Luke Ellis of Baltimore, he'll tell you.

Luke Ellis

Because he got his start in the engineering department of William Cramp & Sons, Philadelphia, a great shipbuilding firm. After his graduation from the Maryland Institute he served as a student engineer in an architect's office, then in Cramp's. The remuneration was nil, but the training and experience was worthwhile.

The first paying job Luke obtained was with the Pittsburgh Construction Company, which engineered and built the West Side Belt Railroad near Pittsburgh, Pa. After completion of this job, he went to work for civil and mining engineers, but a short and sharp depression, as he put it, caused a short circuit in the engineering line.

The Baltimore fire, which occurred in 1904, destroyed the business district of the city, and the services of many engineers were required in rebuilding and improving the burned area.

The City Surveyor was appointed Chief Engineer of the Burnt District Commission, Luke was appointed one of his assistants, then principal assistant. Here he first obtained the experience in municipal engineering which was to be so helpful to him in later years.

When the first steel tower transmission line was built from Holtwood Dam to Baltimore in 1910, Luke served the Susquehanna Transmission Company as engineer. The project was completed just prior to the formation of the engineering department of the Public Service Commission of Maryland.

The desire to enter this new field of engineering relating to the regulation of public utilities tugged hard at Luke, and in 1911 he accepted a minor position in the department.

He then advanced through various classified engineering positions, serving as Acting Chief Engineer from 1929 to 1931. At that time Luke resigned to return to serve the city of Baltimore as the first Associate Engineer to the Chief Engineer.

And just 20 years ago Luke was designated to organize the Bureau of Smoke Control! He became Smoke Abatement Engineer in 1938 when the ordinance was amended changing the bureau to a division.

Seven years of directing and enforcing smoke control were followed in 1939 by appointment to the position of Mechanical-Electrical Engineer and Head of the Bureau of Mechanical-Electrical Service.

Luke returned to the office of the Chief Engineer as Associate Engineer in 1943. In collaboration with the Legal Department an investigation of street lighting rates was made. This extended over a long period requiring inspections, tests, and reports pertaining to the service.

Although Luke returned to public utilities regulation, he never lost contact with the smoke control staff, which continued its efforts to keep smoke emissions at a minimum. He was named Smoke Abatement Engineer in 1947, and resumed direction of the activities of the division.

Having reached the age of retirement in December, 1950, he turned over his work to Milton Reizenstein, one of his former assistants, and, to quote Luke, "a very capable successor."

Here's to you, Luke, and a happy and serene retirement.

EAST CENTRAL SECTION MEETING ATTENDED BY 102 MEMBERS AND GUESTS

by L. E. BUNTS
Smoke Regulation Engineer
Akron, O.

Another successful meeting can be chalked up by the East Central Section of the Air Pollution and Smoke Prevention Association of America. The eighth semi-annual assembly, held in Akron, O., on February 7 and 8, can compare in interest with those held in Detroit and Pittsburgh within the past year and a half.

Participation in the question-and-answer period following presentation of papers indicated that the program was highly interesting to those who attended.

Arthur Bethardy, of the Abco Incinerator Corporation, for instance, stressed the need for commercial and small industry size incinerators that will perform within air pollution control limits and still not be priced out of the picture.

G. W. Roberts, President of the Ohio Blow Pipe Company, described the application of various types of dust collectors for nuisance abatement. He gave a first-hand account of many collection problems that had been presented to his company and explained the methods used to control them effectively.

Slides Illustrate Paper

The development of the cyclone furnace and its application to Babcock & Wilcox boilers was described by F. G. Ely, of the Babcock & Wilcox plant at Alliance, O. He illustrated his paper with slides. Included were graphs representing tests run on the cyclone furnace showing high ash entrainment in the slag tap and marked decrease in fly ash discharged from the stack, thereby reducing this form of air pollution.

Akron's Mayor Charles E. Slusser greeted the group at the Thursday luncheon and expressed his interest in the work of the organization. Ray J. Wilcoxon, of the Republic Steel Corporation, spoke on "Why Make Life Difficult?" While the subject was not directly concerned with air pollution control, the application of job simplification to achieve desired results with a minimum of effort left everyone with something that may come in handy when the proverbial log jam needs breaking up.

Public Relations Necessary

Douglas C. Turnbull, Jr., Executive Assistant to the President of the Baltimore & Ohio Railroad, spoke of the railroads' interest in the APCSPAA program from the standpoint of public relations and savings in operation. A fine example of down-the-line interest and cooperation was shown when he called

A group from the East Central Section which visited the B. F. Goodrich Laboratory in Brecksville, O. Front row, left to right: H. Morris Gard, Canadian Industries, Ltd., Windsor, Ont.; M. L. Cooper, National Coal Association, Pittsburgh; W. C. Holton, Battelle Memorial Institute, Columbus; Erik N. Nelson, Ohio Edison Company, Akron; Charles W. Rossa, Road Foreman of Engines, Erie Railroad, Marion, Ohio; E. W. Edwards, Chairman, Barberton Smoke Commission; Dr. Douglas Beech, Goodrich Laboratory. Second row, left to right: Robert Morris, Goodrich Laboratory; Roscoe Albaugh, Akron Board of Education; Charles N. Howison, Smoke Abatement League, Cincinnati; Robert Carson, Executive Secretary, Barberton Chamber of Commerce; Ted Frampton, Burkhardt Brewing Company, Akron; Don Cornell, Goodrich Laboratory.

on J. E. Maxwell, local superintendent, who, in turn, asked G. M. Swartz, road foreman of engines, to tell of their part in "Railroad Contribution to Air Pollution Control."

Cory C. McClelland, Bailey Meter Company, described control equipment and instruments developed and produced to assist owners and operators using fuel burning equipment to achieve more efficient combustion and reduce atmospheric pollution.

A. L. Kiewit, of the Coal Producers Committee for Smoke Abatement, Cincinnati, told of his experiences in hand-firing warm air furnaces simulating conditions where these units are used. Smoke records taken during the test showed what could be expected if procedures were followed.

Much Money Spent

Thomas B. Brafford, Local Manager of the Crane Company, chairman of the Akron Chamber of Commerce Smoke Abatement Committee, gave a factual report of the experiences had by a number of Akron plants when they made the changes necessary to conform with the Smoke Regulation Ordinance. He stated that more than $11,000,000 was being spent on air pollution control equipment in Akron, and many firms were satisfied that operating costs had been reduced enough to show a real saving.

William Wilson, Chief Industrial Hygienist, Cleveland, spoke on Friday on "Paint Panel Exposure to Determine Air Pollutants." This comparatively inexpensive method, he stated, has been thoroughly explored by the Cleveland Air Pollution Division and should be a valuable asset to control officials.

Herbert C. Johnson, Assistant Smoke Regulation Engineer, Columbus, pointed out the benefits of periodic inspection of fuel burning equipment. His comprehensive report brought out management's interest and the value of complete records necessary to sustain a successful air pollution control program.

Dust Fall Standardization

"Should Dust Fall Methods Be Standardized?" was the subject of the address given by Charles W. Gruber, Chief

Visiting the Babcock & Wilcox plant during the East Central Section's two-day meeting in Akron were these gay musketeers. Front row, left to right: Arthur Bethardy, M. S. Cole, Herbert C. Johnson, G. Harris, George G. Keller, John R. McCain, Lou Bunts. Second row, left to right: H. B. Brawner, H. R. Croysdale, W. I. Rauh, Richard Goder, J. A. Strider, T. J. Wells, Ellis Smauder. Third row, left to right: John C. Marks, Joe Reid, Earl A. Campbell, A. F. Paulin, Ernst Graf, H. Kenneth Kugel. Fourth row, left to right: Harry C. Ballman, H. W. Lincoln, Ralph W. Bourne, W. C. Wagner, F. J. Leonhard, Roger J. Browne, Jr., Tom Kinder, Fred Classon. Fifth row, left to right: D. E. Humphrey, Harold Nielsen, Charles W. Gruber, J. G. Mingle, Eli May, Howard J. Scott, Arthur Kunzman.

Smoke Inspector, Cincinnati. He covered Cincinnati's 20-year experience with dust fall jars and other methods. His informal talk was followed by a lively discussion, with the majority feeling that standardization has merit.

Walter I. Rauh, Chief Smoke Regulation Engineer, Youngstown, reported that his city's program is getting good cooperation, but that limited personnel might retard the progress.

At the close of the meeting, the attendance split into two groups. One visited the B. F. Goodrich Research Laboratory at Brecksville, O., while the other group toured the shops of the Babcock & Wilcox Company at Barberton. The East Ohio Gas Company sponsored a pleasant social hour on Thursday night.

SHOULD DUST FALL METHODS BE STANDARDIZED?

by CHARLES W. GRUBER
Chief Smoke Inspector
Cincinnati Bureau of Smoke Inspection

Excerpts from an address presented at the East Central Section meeting of the Air Pollution & Smoke Prevention Association in Akron, O., February 7 and 8, 1952.

More than 14 cities are conducting dust fall studies, and there are only two procedures common to the work: 1) jars are set out monthly, and 2) results are reported as Tons per Square Mile per Month*.

To the average citizen, "tons per square mile per month" in Pittsburgh, Columbus, and Cincinnati are comparable; to the air pollution control engineer, they are as different as pears, peaches, and papaws, and comparison, without some measure of standardization, is absolutely meaningless.

Why not standardize?

Some say it can't be done, because the *identical* situations cannot be set up in city for city. That is true, but there are many items which could be standardized by simply agreeing on the best procedure.

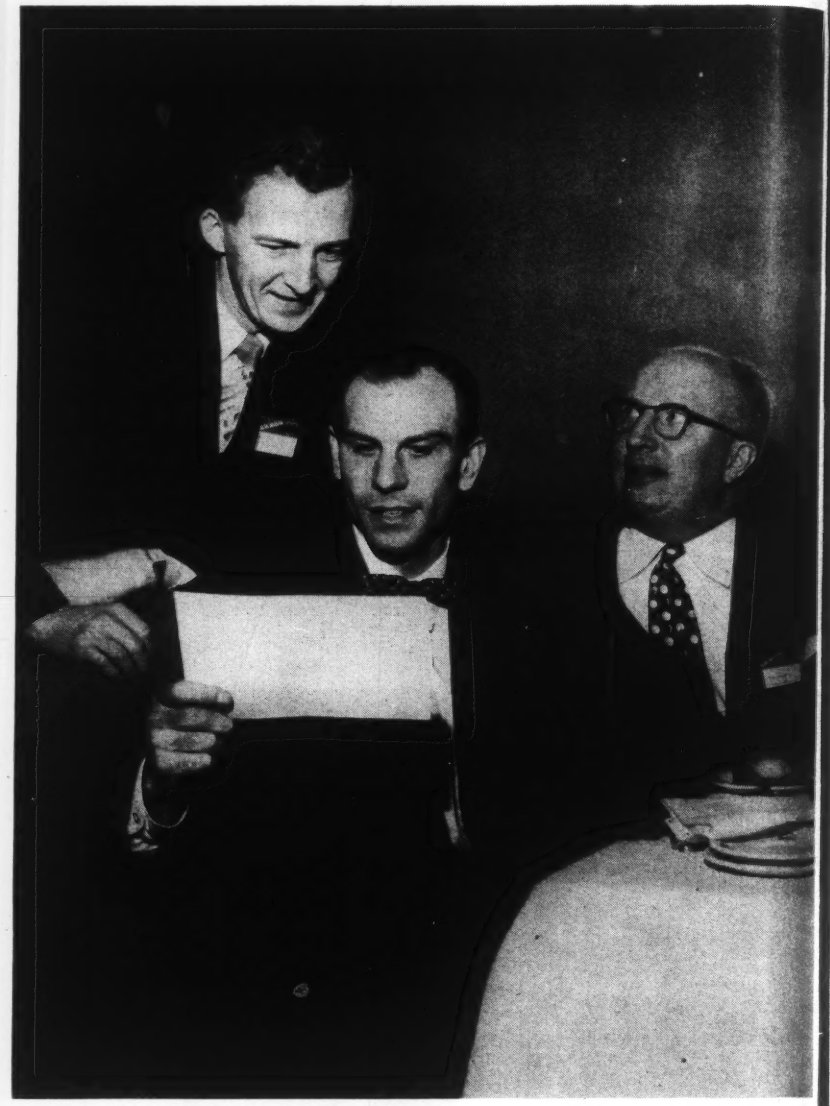
Readings Vary Greatly

In dust fall measurements, little changes make big differences. For example, in Cincinnati, for the sake of maintaining continuity with a system which was begun many years ago, jars on flat roofs are set right on the roof. Unusually high readings have been recorded for some months, particularly for those in which squally weather appears.

In order to check the influence of height off the roof, duplicate jars on tripods were set out at three different locations for the past year. Comparing the 36 monthly readings, it was found there is a wide difference in results from jars set one on the roof, and one four feet above the roof.

In five readings only, out of the total of 36, there was less than a 5 percent difference between the two jars. In two of the readings, the tripod jar was 46 percent less than the roof jar. It was also noted that the tripod jar produced more consistent results than the roof jar.

* Refer to *Dust Fall Studies*, by Ernest B. Brundage. Proceedings of the Annual Meeting of the Smoke Prevention Association at New York, 1948.



Lou E. Bunts, Smoke Regulation Engineer of Akron, looks over the shoulder of Ray J. Wilcoxon, of the Republic Steel Corporation, during luncheon of the eighth semi-annual meeting of the East Central Section of APCSPAA. Tom Brafford, co-chairman of the program committee and chairman of the Akron Chamber of Commerce Smoke Abatement Committee, watches with interest.

Consider 10 Items

The following 10 items should be considered in working toward standardization of dust fall collections:

1. *Type and size of containers.* Glass, copper, and stainless steel are used. The containers are generally 5 to 6 inches in diameter, 8 to 15 inches high, and straight sided.

2. *Type of holder.* The height above the ground or roof should be established. What would be preferred?

3. *Location of jar.* Should jars be at breathing level, 14 feet above the grade on low roofs, select two-story buildings, or should they be put up high on top of high buildings downtown?

4. *Collections.* Should they be made wet or dry—that is, should liquid be placed in the jars when they are set out?

5. *Anti-freeze.* What type should be used?

6. *Algae inhibitor.* Should it be used?

7. *Duration of exposure.* The 30-day exposure appears to be common to all cities at the present time.

8. *Method of analysis.* Should the soluble portion of the solids be determined? Is the pH of the liquid of any value? Is there any adverse effect due to storing the samples before analysis? There appears to be considerable growth in the jars if they are stored in the summer time. What is the significance of algae growth in the jar, and how should it be handled? What is the significance of extremely high data as is often found during the months when squally rainstorms or high winds re-deposit surface dirt into the jar?

9. *The method of calculating and reporting* is of importance. Should the city average be a numerical average, or should an area be assigned to each jar, and the value of the jar weighted according to the area which is served?

10. *Selection of the sampling stations.* How many jars should be put out? What should be the underlying principles in selecting the sampling stations?

There will be no attempt to answer the foregoing questions. The answers should be produced by a committee. As previously stated, some points will be readily agreed upon; others will be argued into the night.

De-Emphasize Measurements

Dust fall studies have been unduly emphasized as the key measuring stick for all air pollution. No doubt this has been due to the fact that until recently dust fall studies were the only measurements made by smoke regulation bodies.

Dust fall measures only one segment of air pollution—the heavy settling solids. The suspended solids, the aerosols, and the gaseous and odoriferous contaminants of air pollution are not a part of dust fall studies.

A program geared to the reduction of visible smoke will not influence dust fall studies in the same proportion as the success of the efforts. There are other factors which have more influence on dust fall than visible smoke.

Equipment Simple

Air pollution control engineers are giving much thought to the means of quantitatively determining all air pollution and not the settling solids only. Dust fall measurements should be continued and probably standardized, but should also be de-emphasized.

Ways and means of measuring other air pollution by relatively simple, inexpensive instruments must be found. One of the reasons dust fall studies have been so popular is that they can be made with simple, inexpensive equipment and require little specialized skill.

Jim Cudbird rows across Lake Erie to get to Cleveland from Canada.

Any chemical laboratory can make the analysis of the jars after they are set out and collected. The expense connected with complete quantitative studies of air pollution is enormous, and in general is above the reach of the pocketbook of the average municipal program.

Witness the comprehensive area-wide air pollution study being sponsored by the Technical Advisory Board to the International Joint Commission going on in Detroit at the present time. It was stated at the Detroit meeting of the East Central Section of AP&SPAA last September that the total cost from all sources for the five-year program will be approximately $1,000,000.

Quantitative Determination

There is, however, currently going on in communities such as Los Angeles County, Cleveland, Pittsburgh, Columbus, and Cincinnati research programs to determine air pollution quantitatively. It is believed that out of such work, together with that being done by scientific research institutions sponsored by industry, that a practical approach to air pollution measurement will be evolved.

Stanley R. Hall, Research Engineer for the Albert L. Chaney Chemical Laboratory, in his paper *Instrumentation for the Recording of Air Pollution Levels*†, describes many practical instruments for quantitatively determining air pollution.

The automatic air filter developed by W. C. L. Hemeon, Engineering Director, Industrial Hygiene Foundation, under a project sponsored by the American Iron and Steel Institute, has good possibilities of becoming a simple, practical, inexpensive instrument for quantitatively determining suspended solids.

The directional dust fall measuring device developed by Dr. Hamnett P. Munger at Battelle Memorial Institute will provide directional information and thus increase the value of dust fall data.

AP&SPAA Clearing House

AP&SPAA headquarters is the natural clearing house for information regarding air pollution measurements. The current staff has more than it can handle at the present time, but a system of reporting results of current, continuous air pollution testing programs to headquarters would be a valuable project when more than one community is making similar studies.

Smoky Bear Restricted

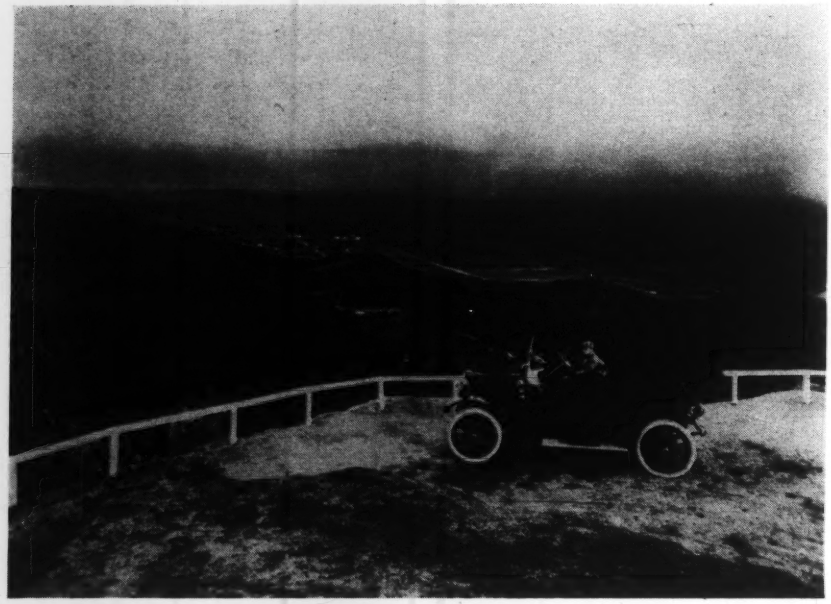
The Smoky Bear symbol, used in anti-forest fire advertising, will be restricted to public service ads, in accordance with action taken by the U. S. Senate.

This resulted from Smoky Bear products developed by promoters, thus irking state education boards. However, the Secretary of Agriculture can permit uses of Smoky if "consistent with the public interest."

† Presented at AP&SPAA Annual Meeting, Roanoke, Va., May, 1951.

SMOG LORE

by
R. D. CADLE and HENRY C. WOHLERS
Stanford Research Institute
Stanford, California



Hollywood 1922—Is It Smog?

Pity the poor scientist who must deal with the Los Angeles smog. He is faced with an impatient and sometimes unreasonable public that tries to drive him into hurried conclusions through alarmist newspaper stories, radio jokes, and public conclaves.

He must answer a hundred amateur "helpers" espousing as many fantastic schemes to conquer smog. He must weather intense political pressure to find an overnight solution to an immensely complex problem. Even among his colleagues, he finds honest disagreement. Upon such quicksands, the scientist must erect his cherished ivy-manteled tower.

Over a million dollars have been spent in recent years by several agencies in the study of Los Angeles smog. For the most part, this money has been intelligently spent. Much is now known about smog. Perhaps even more important, what is still to be learned is at least partly defined. In that fact lies the hope for the future.

As long as smog brings tears to the eyes of citizens of Los Angeles and obscurity to their views, the pressure for a solution will remain. As long as the public pressure remains, money will be found to support research on smog.

And, in the long run, it may confidently be stated that research will reveal what must be known about smog. Given that understanding, smog perhaps can be eliminated from the justly famous climate of the Los Angeles basin.

No One Has All Answers

Perhaps the most amazing property of smog is that mere contact with it seems to create a smog expert. These voluble experts have proposed myriad cures for smog and as many reasons for its existence.

Many of these cures and reasons have much to recommend them; others cannot be so charitably described. The very fact that so many people lay claims to the ultimate solution—and each is unique—points up the really important fact: no one has yet all the answers.

In this paper, some of these suggestions—good, bad, and indifferent—are set forth. These theories are interesting in themselves. Moreover, they lead to the inescapable conclusion that more facts and a better fundamental understanding of the chemistry, physics, and meteorology of smog must be acquired before clarity can replace the haze.

The History of Smog

Even the term "smog" itself is a source of some confusion. In some cities where smoke is the primary problem, smog is taken to mean the combination of smoke and fog—from which two words the term derives.

In Los Angeles, however, which is a gas- and oil-burning rather than a coal-burning community, soot presents almost no problem. The nebulous term "smog" has, therefore, come to mean in Los Angeles any polluted atmosphere that bothers people.

Generally, eye irritation, severe haziness, and crop damage are characteristic of smoggy weather. Physically, this smog consists of no single impurity, but rather is a complex mixture of gases and solid and liquid particles.

Spaniards Sensed Smoke

Spanish explorers, 270 years ago, described the Los Angeles region as the "land of smoke and fires"—presumably because of an intense haze they saw from the sea. Does this imply that smog in some form or other existed even in those days?

The Los Angeles basin is closed off by mountains on three sides, and often by a gentle sea breeze on the fourth. During the summer and winter months, the action of the large stable high pressure area extending from the Los Angeles coast to the Hawaiian Islands often creates a sharp and strong inversion layer over the basin.

This inversion layer, acting as a lid over the basin, traps the contaminants in the atmosphere and holds them more or less immobile in the Los Angeles air for many days in a row.

Trouble 84 Years Ago

The records of Spanish explorers are not the only ones which indicate that Los Angeles has long been subject to air

Dr. Richard D. Cadle, senior physical chemist on the air research staff of Stanford Research Institute, Stanford, Calif., is a native of Ohio who listened to Horace Greeley. He earned his Ph.D. at the University of Washington, where his doctorate work covered the physical chemistry of dilute solutions of colloidal electrolytes. Dr. Cadle served as a chemist with Procter & Gamble and the U. S. Navy. He joined Stanford in 1948. He has done research in the fields of colloidal chemistry, chemical kinetics, anti-oxidants, rocket propellants, and explosives.

pollution. In 1868, when Los Angeles was still a drowsy hamlet, a resident of the town wrote to the editors of the San Francisco paper *Alta*:

It is now about six days that we have in this and the surrounding country been the spectators of an unusual atmospherical phenomenon, which, from its peculiarity, has given occasion to manifold surmises, conjectures, speculations and rumors. The atmosphere has been so filled with smoke as to confine the vision within a small circumference. And as the smoke was wanting in those aerial properties which affect the eyes and nostrils, there were not wanting many who denied the assertion that it was smoke.

Others who assented to the fact that it was smoke, contended that it was a new, uncommon kind of smoke, and were ready to attribute it to the earthquakes of South America, while others knew that the Island of Guadalupe, off the coast of Lower California, has been rent in twain, and that, from the chasm, which was miles in extent, was pouring forth such a mass of smoke as would, in a few weeks, change the atmosphere of this globe into one similar to that which ascends continually from the bottomless pit. Others, a few only, advanced the idea, which gained but few adherents, that it was ordinary smoke, produced by the burning of vegetable matter at a distance so far off — probably Oregon or Washington Territory—that it had lost its acrid properties during its suspension in the atmosphere.

It is interesting that this smoke did not cause the eye irritation which seems to be so characteristic of present-day Los Angeles smog.

Photo Doesn't Lie!

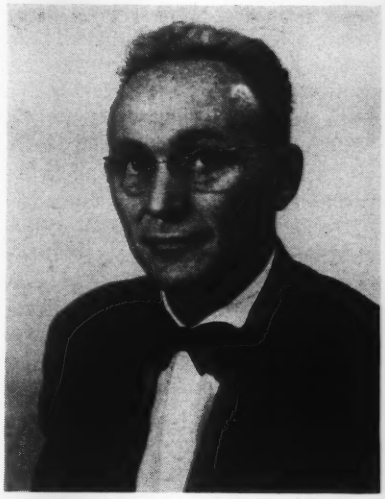
The accompanying photograph, taken in 1922 from a hill above Hollywood, shows an intense haze lying over the basin. There is no way of telling from the photograph whether this haze has a natural origin such as dust, pollen, sea salt, and other materials of plant and animal origin, or whether it consists of smoke and fumes spewed forth by the activities of man.

Since the early 1940s, that is, since the tremendous growth of Los Angeles, the intensity of smog and the unpleasantness of its effects have increased greatly. Dr. Francis M. Pottenger, Jr., writing in the interim report on air pollution research, published by the Assembly of the State of California, April 13, 1950, observed:

When the smog first began in 1942 everybody considered it essential to the war effort. We considered it necessary because things were let down and I don't think people complained about it, but those of us who have been interested in chest diseases and respiratory diseases saw a great change take place in our people.

We don't know what causes smog. It's one of the things our medical society wants determined. We can't say that it's because of this industry or that industry, that we are having more respiratory difficulties among our patients. We can't say it's because of this industry that we have more runny eyes, but those are the things that must be determined before anyone can say, "Now, this has got to stop."

Dr. Louis C. McCabe, former Director of the Los Angeles County Air Pollution Control District, says that smog, as we now know it, first appeared in Los Angeles in 1943.



Air pollution problems are the gremlins who haunt Dr. Henry C. Wohlers in the chemistry department of Stanford Research Institute, of which he has been a member since 1949. He studied at St. Lawrence University, then the University of Munich, and received the degree of doctor of philosophy from Stanford University. His previous experience includes analytical, research, and pilot plant work for the General Chemical Company and the Dorr Company, as well as research on growth hormones for the Boyce Thompson Institute for Plant Research.

Public Indignant

With the end of the war came tremendous public indignation over smog, an indignation that was taken up, echoed, and enlarged by the local newspapers until word of smog spread across the country. As a result, the Los Angeles County Air Pollution Control District was formed by state law in October, 1947.

This law, which is a part of the state health and safety code, channels state power down through the Board of Supervisors of any participating county and empowers the setting up of governmental machinery to combat air pollution.

The life of the Air Pollution Control District has not been an easy one. An impatient public has seriously considered recalling the Board of Supervisors and, at times, has attempted to take matters into its own hands by demanding the shut-down of oil refineries during periods of smog.

Another result of the public clamor was the formation of research programs by various groups for the purpose of finding out what smog is and what can be done about it.

Field and laboratory research has, at various times, been carried out by Los Angeles County, by the California Institute of Technology, by Stanford Research Institute, by the University of California at Los Angeles, and also by various consulting laboratories in the Los Angeles area.

Many of the most eminent scientists in Los Angeles have devoted a good deal of time to the problem, and air pollution experts have been consulted from every corner of the globe.

Smog and What It Does

As the intensity and frequency of smog steeped up during the war years and afterwards, a number of new effects were noted during periods of smoggy weather. Not only did at least half the denizens of Los Angeles find themselves weeping on the pavements of their city during intense attacks, but some people noticed blackening of paint on their homes and the formation of an oily deposit.

Oh, dry those tears!

Possibly these effects stemmed from localized high concentration of contaminants in the air rather than from the larger scale movement of smog clouds. Particularly in recent years, many truck farmers throughout the basin have claimed widespread damage, especially to leafy crops, as a result of smog fumigations. A. J. Haagen-Smit, of the California Institute of Technology, has studied this effect extensively.

Ozone Cracks Rubber?

Rubber goods seemed to undergo severe cracking during periods of smog. Investigations carried out mainly by A. W. Bartel of the United States Rubber Company indicate that this cracking may be due to ozone in the air. This powerful oxidant may or may not be a naturally occurring material.

There has been much discussion in various quarters of the damage to health which may result from living in a smoggy area. Pneumonia, tuberculosis, bronchitis, and cancer of the lungs have been specifically mentioned as diseases which flourish in polluted air.

Medical men claim that industrial pollution of the atmosphere often is a serious nuisance and occasionally is a source of irritation and discomfort to the eyes and lungs. That it is a more serious threat has yet to be proved.

Smog Hurts Complexions

The ladies, too, have complained of smog. They say it damages their complexions. In the motion picture industry, bleached blondes are normally retouched once a week, but on smoggy days the peroxide must be administered daily. According to one article, the organic peroxides in smog turns the retouched parts of blonde hair green.

There have been complaints of nylon stockings disintegrating on legs in downtown Los Angeles. An interesting statement was attributed to an optometrist:

"I had a patient who came out from the east—a man who wore a glass eye—and had to buy a new, bloodshot eye, to match his good one."

This catalogue could be extended almost indefinitely. Some claim that Los Angeles cats and dogs are not as healthy as they should be. Newspaper articles have attributed automobile collisions to the haziness created by smog. And so it goes.

Tourist Trade Declines

Probably a very real economic loss caused by smog is the decline of the tourist trade which stems from the unfavorable publicity given to the Los Angeles climate. Hotel owners were warned in 1949 that smog would probably reduce tourist revenue as much as $73,000,000 a year.

Surprisingly enough, smog is also claimed to have certain beneficial effects. According to a letter printed in the Los Angeles *Times*, health-giving smog cured a man's corns. Another gentleman stated that his nostrils had been congested for 30 years and that smog cleared them up. An old lady was so convinced that smog

Cat: "Wowzie!"
Mouse: "Me, too!"

was healthful that she never needed to take vitamin pills again.

And what would radio gag writers do without smog?

A Few Theories

During the several years that smog has been in the public eye, a number of quaint proposals have been set forth to account for smog. In keeping with the times, it has been suggested that nuclei resulting from atomic explosions cause the particles that make up much of smog. Cigarette smoke has been charged with major possibilities.

One of the less quaint of these holds that smog is derived entirely from natural sources of pollution, such as dust blown from the earth, salt from the sea, and pollen from the fields surrounding the city.

The great number of pepper trees in the Los Angeles area gave rise to one thought that the essential oils produced by these fine ornamentals is the ingredi-

ent responsible for eye irritation. Inasmuch as eye irritation is evidently a relatively new phenomenon, the natural theory would not appear wholly adequate.

Caused by Plastic Gas?

Perhaps the liveliest explanation for the cause of smog is contained in a letter sent to the Stanford Research Institute by a woman living in the Los Angeles area:

If you wish to find out the cause of smog, why not look to the newest industries that have increased in the last eight years. The plastic industry could be the guilty one. I bought a chair made of it and when I sit in it the body heat causes a gassy vapor that makes my nose and eyes smart and smells just like the Los Angeles smog.

Smog cured Granny.

Even more vigorous proposals have been put forth as panaceas for smog. One lady suggested "throwing the dirty industrialists into the sea."

Aerial Sewage Disposal

One widely suggested method, which has received a considerable amount of attention, consists essentially of blowing smog out of the Los Angeles basin by one or another means.

A meteorologist suggested an "aerial sewage disposal system" to eliminate smog. This would consist of a series of stacks built atop hills in the area. These stacks would rise high enough to penetrate the inversion layer (often at a height between 500 and 2,500 feet) so that the smog clouds could be vented to the giant spaces above.

Other persons have suggested building such stacks, not necessarily on hilltops, but in such a manner that a natural draft would sweep up through the vents. A variation on this cure-all involves drilling tunnels through the mountains separating Los Angeles from the Mojave Desert. Huge fans placed in the tunnels would draw the smog from over the basin and blow it out on the desert.

Many Difficulties

There are many great difficulties in carrying out any such scheme. We calculate that about 180 cubic miles of air must be moved daily. If the proposed vents had a cross-sectional area equivalent to one city block, and if 12 vents were used, air would have to be forced up these vents at a velocity of more than 75 miles per hour, if the entire volume of air is to be removed within 24 hours.

This, in itself, would be no mean trick.

In addition, engineers at Stanford Research Institute calculated that the heat required to break through the inversion layer would possibly take the energy of 3,500,000 barrels of fuel oil. This is roughly seven times the amount of fuel handled by the combined refineries each day in the Los Angeles area.

Paint Roofs Black

In view of Los Angeles' reputation for sunlight, it is not surprising that one person, at least, suggested that heat from the sun be used to help dispel the smog. It was proposed that roof tops in the city, and perhaps streets and sidewalks as well, should be painted black.

The idea was that the heat absorbed would create huge turbulent currents in the air which would somehow dispel the smog.

A similar suggestion was made in a more grandiose style. The sides of the mountains flanking the basin at certain strategic points would be covered with a series of reversible sections similar to the slats on venetian blinds. Each section would be highly polished aluminum on one side and would be painted black on the other.

These sections could be flipped over electrically from a central location. When the polished surface glittered in the sun, a wind would be created, according to the theory, which would blow pollutants away and over the mountains. The cost was stated to be "10 years' expenses of a smog experts committee."

Use Publicity Hot Air

A most unusual suggestion—one suspects an Easterner—was the tongue-in-cheek notion that smog might easily be vanquished merely by rounding up all members of the city's various publicity staffs, arranging these persons on the summits of the Sierra Madre Mountains facing the coastal plain, and encouraging them to recite the advantages they have brought to the area. It would then be necessary only to sit back and watch the smoke hustle seaward.

Somewhat more serious ideas have been put forth to cure the smog problem,

The culprit: Plastics!

which would involve destroying the inversion layer by cooling the atmosphere with water dropped from a fleet of bombers. The author of this suggestion was very careful to point out that it probably would not be economic.

Another thought along this line was to install a sprinkler system on the high buildings of downtown Los Angeles. The person who suggested this idea stated that smog accumulates in downtown Los Angeles and that sprinkling between six and seven in the morning would remove the smog.

Try Perfume!

A perfume company came up with a fascinating way to overcome the odor of smog. It picked Los Angeles as the target for the world's first mass perfume bomb-

ing. Fifteen planes attempted to saturate the city's air from an elevation of 1,500 feet.

An imaginative solution was to rid the city of its old open-burning garbage dumps by boring a hole down through the side of one of the mountains rimming the basin until the heat of the earth's center is tapped.

This hole would act as the chimney of this garbage disposal unit. The volcanic furnace could then be used for burning the city's rubbish and garbage. The cost of setting up this system, it was explained, would be paid for by the steam and electricity generated by the burning of the garbage.

Some people, having apparently less faith in their capacity to overwhelm the smog problem by the powers of the mind —or perhaps just being better businessmen—prefer to treat the symptoms. The Los Angeles papers have contained advertisements for drops which would decrease the eye irritation that smog causes. Deodorants, too, have been suggested to remove the smell of smog from offices and homes.

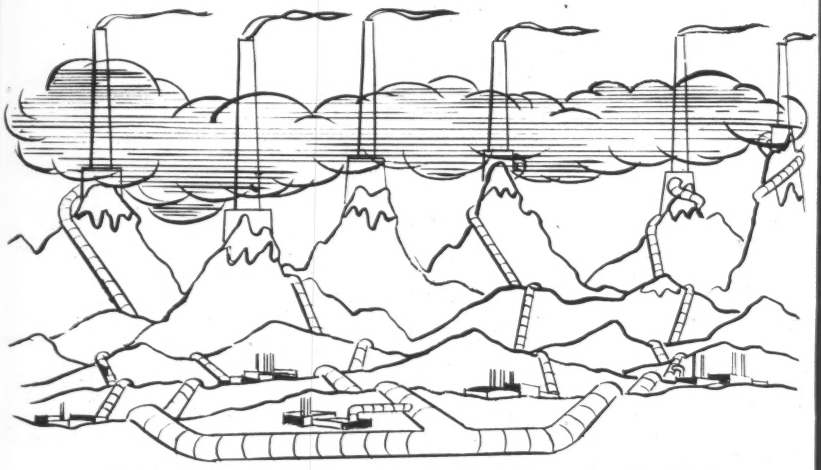
What We Do Know

Knowledge concerning smog is still incomplete, but the fact remains that a great body of proven fact has now been accumulated by research in chemistry physics, plant pathology, meteorology, and other fields of study.

As far as is known, the unpleasant effects of smog may be attributed either directly or indirectly to the effluents given off by the imperfect combustion of wastes and fuels. There still remains a considerable amount of uncertainty concerning the relative importance of various organic substances that have been identified.

Automobiles undoubtedly pour out tremendous quantities of pollutants into the Los Angeles air. As a result, they have received considerable research attention. Some scientists have stated that automobiles, and particularly those in poor mechanical condition, are major contributors to smog.

Others claim that automobile exhaust gases, although they may cause some of the smog, are probably relatively unimportant. In this connection, it is interesting to note that there was considerable local opposition to the replacement of electric street cars with motor buses because of the extra fumes the buses would create.



Aerial sewage disposal. Ducts carry smoke from plants to huge stacks that pierce the inversion layer.

A California Institute of Technology scientist is quoted in the Los Angeles *Times* as saying that gasoline exhaust fumes of thousands of automobiles during the heavy traffic of the Tournament of Roses practically exterminated Cal Tech's test plants.

Those Pesky Hydrocarbons

Analyses of the Los Angeles air have shown that smog contains hydrocarbons, including olefins. These products may come from automobile exhaust gases, from other combustion sources, from refineries, and from evaporation losses of gasoline.

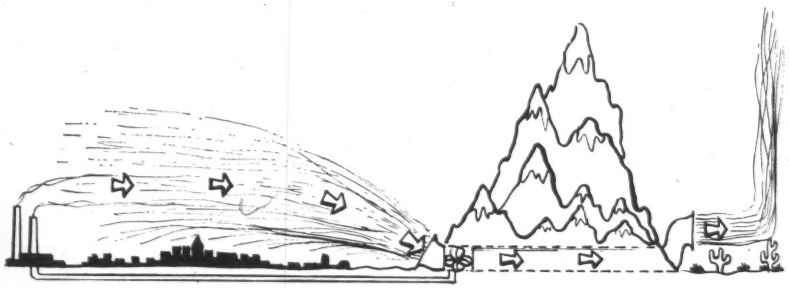
It is believed by some that the reaction of these olefins with oxygen, ozone, and oxides of nitrogen in the air contribute to smog. It is possible, too, that these reactions account for the relatively high atmospheric aldehyde content during smoggy weather.

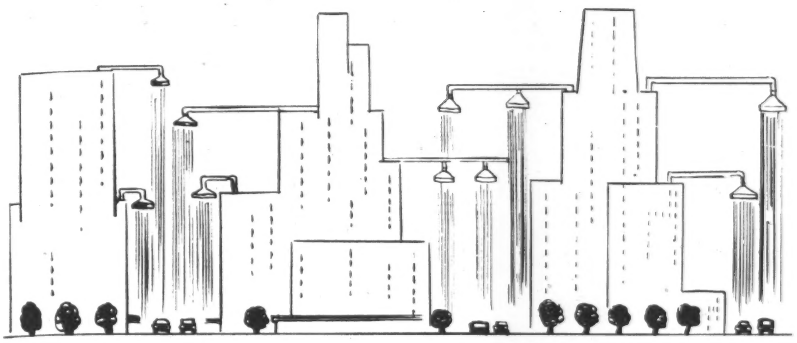
Automobile exhausts have come in for their share of thought. In some localities ordinances have been passed to ban the smoky automobile from the road. Some work has been done on equipment that might be attached to automobiles which would remove the obnoxious portions of the exhaust fumes. Some have proposed that additives be invented to put in the crank cases of cars and thus decrease the quantities of objectionable materials in the exhaust.

Trash Also Responsible

Another major source of organic material in the air is more or less peculiar to Los Angeles smog. It is practically the only major city in which almost every home owner burns his grass clippings and other accumulations of trash. Research indicates that backyard incinerator smoke may contribute materially to smog. The incinerator, however, is a highly inflammable subject because the substitution of city-wide trash collection would increase taxes.

Fans located in huge tunnels draw the smog through and redeposit it in the desert.





Sprinkler system on skyscrapers settles smog. Oh, yeah?

Proposals have been made that the backyard incinerator should be eliminated, and that garbage be burned at a public incinerator or be disposed of by burning. Similarly, motions have been made to shut down open-burning garbage pits.

Industry Blamed, Too

Finally, a good many data have been secured in several studies indicating that industrial sources, such as iron foundries, railroad smoke, plastic or rubber plants, butadiene plants, and oil refineries contribute substances contributing to smog.

During the war many people felt that the butadiene plants were the main contributors to the eye irritating properties of smog. It came as a surprise to many that smog remained unchanged after the shut-down of the butadiene plants at the end of the war.

It has been proposed that powers be given for the control of industrial activity of all sorts so that the amount of pollution entering the air can be restricted. Associated with this proposal is the idea that an accurate means of forecasting smog should be developed. When meteorological conditions favor smoggy weather, it would then be possible to shut down or reduce industrial activity. Obviously, this is a step having drastic economic implications.

In general, all of man's activity involving burning — whether it is Mrs. Jones roasting her hot dog at a barbecue, or the furnaces that heat homes and offices, or the incinerator and dumps that burn the city's garbage—contributes to the air's burden of organic pollution. The haziness that comes with smog is probably caused by very small, essentially aqueous droplets that are also released by all combustion processes.

Where Do We Go From Here?

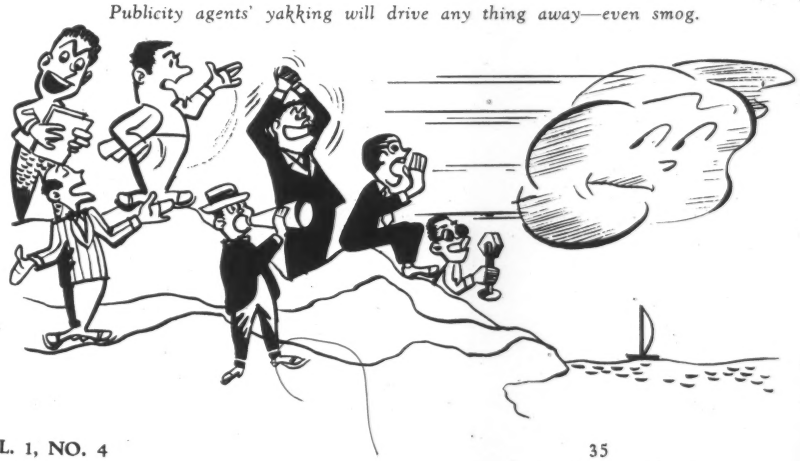
At present, scientists are not in a position to scoff too openly at the multitude of "experts" who offer solutions to the smog problem. At least one generality may be put forth with confidence.

The way—and probably the only way —to eliminate smog is to find out exactly what materials are in the air, the sources of these materials, the history of them after being air-borne, the mechanics of their action, and the means by which they exert their effects.

These matters must be understood not only with respect to eye irritation, but to crop damage, effect on health, visibility, and many others. Some of the answers are now available. But more extensive knowledge, it now seem is needed. This means that a great deal of fundamental and basic research is called for.

When the basic principles and their applications controlling the action of smog are understood, and only then, are we likely to understand enough to be really intelligent about decreasing the sources of smog and returning the famous climate of Southern California to the Los Angeles basin.

Publicity agents' yakking will drive any thing away—even smog.



Thomas F. Troy

THANKS!

When he sent in the application blank made out for the Hotels Statler Company, Thomas F. Troy, General Manager of the Hotel Statler in New York, wrote:

"I was in St. Louis when the smoke ordinance was passed, and, as you know, I had a little something to do with smoke control, in Pittsburgh. I am interested in the entire movement, and hope that a great deal of additional progress can be made."

CONTROLLED OVERFIRE AIR SYSTEMS

Their Success Lies in the Fact that they are Carefully Engineered for each individual Installation

by SHERMAN J. LARSEN
Manager
PliOjet Overfire Air Department
Plibrico Jointless Firebrick Company
Chicago

Medical research is compiling statistics on the direct cause-and-effect relationship between smoke pollution and endangered public health.

Fortunately, while such evidence is being assembled, there has been an equal mounting of awareness on the part of industrial plants and business firms that smoke should be abated to serve the best interests of the community.

Many firms are leading the way by tackling the smoke problem voluntarily. This spirit of cooperation reflects the progressive attitude of the modern business concern which recognizes its community responsibility.

One such case was pointed out in the November, 1951 issue of AIR REPAIR, that of the Pittsburgh Plate Glass Company's plant at Keene, N. H. The equipment installed in this plant, which so effectively overcame the smoke conditions there, is the PliOjet overfire air system of smoke abatement.

Not a Cure-All

In addition to improved community relations, the increase in combustion efficiency provided by overfire air jet systems has resulted in more efficient use of fuel with consequent savings in fuel dollars. They clear up smoke conditions which are caused by inadequate air supply over the fire or by poor mixture of air and combustible materials.

PliOjet is not a cure-all, and the firm is quick to point this out. Plibrico specialists can be exceptionally accurate in the analysis of a smoke condition. In their work as refractory specialists—they originated refractories in plastic form—they have had broad experience with every type of combustible and combustion equipment. This experience enables Plibrico to pinpoint the cause of a smoke problem. In fact, it has published a valuable smoke prevention chart which outlines the common causes of smoke and indicated remedies. Copies of this chart can be obtained without obligation by writing to AIR REPAIR.

When the cause of smoke is determined to be inadequate air supply over the fire, or improper mixture of air and combustible, the introduction of overfire air by means of PliOjet is the suggested remedy. This equipment conforms to the recommendations and specifications of Bituminous Coal Research, Inc., and standards established by Battelle Memorial Institute. It provides the correct amount of overfire air required and creates the turbulences necessary for complete combustion.

Survey Determines Installation

Each PliOjet installation is carefully engineered to meet the individual requirements, and each component part is tailored to the specific conditions. These components include a turbo-blower that delivers the air, and a manifold to which are connected jet nozzles which direct the air into the fire-box. A typical installation is shown in an accompanying photograph; the view of the furnace interior shows the jet nozzles embedded in the bridge wall. The turbo-blower mounted just outside the furnace; through the manifold, also installed in the bridge wall, this blower delivers air to the jet nozzles.

All PliOjet installations are guided by a survey of the furnace involved. From data obtained in the survey the equipment required and the proper position for installations are exactly determined. Jet nozzles, for example, may be installed in the furnace bridge wall, in the front wall, in side walls, or in a combination of these locations.

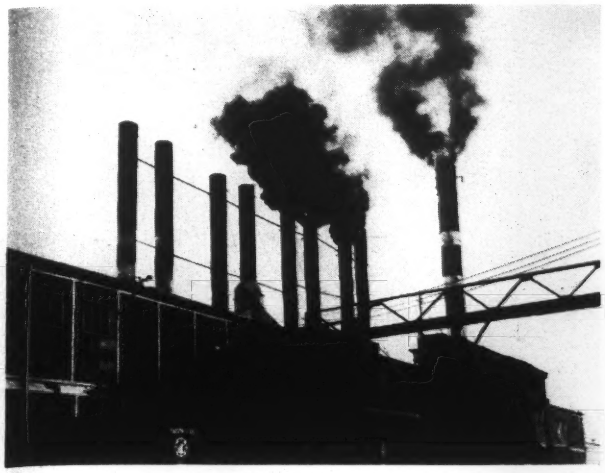
The survey reveals the most suitable and effective placement, and from it can be computed the number of nozzles required, the spacing between them, and the orifice size, so that the air to be delivered will completely cover and penetrate the fuel bed in both length and width. Characteristics required of the turbo-blower are also determined by the survey, and the blower is selected to deliver the exact quantity of the air required for efficient combustion.

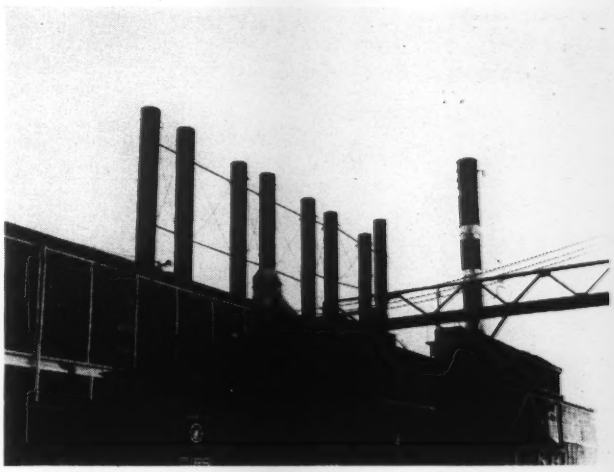
This handsome countenance belongs to Sherman J. Larsen, Manager of the PliOjet Overfire Air Department of the Plibrico Jointless Firebrick Company. He is not only the author of the accompanying article, but also an enthusiastic booster of APSPAA. Note the emblem proudly displayed in his left lapel. You, too, can be as goodlooking if you come across with $3.88, the price of the pin!

Air Carefully Calculated

Jet air streams injected into a firebox provide the oxygen and create the turbulence needed for thorough intermixing of combustion gases. The air introduced should not be confused with superfluous air, air which serves only to reduce smoke density by diluting the combustion products.

The amount of secondary air is carefully calculated, and the primary air ordinarily used can be reduced by an equal or greater amount; thus the total air





These photographs, taken moments apart at Ft. Holabird, Md., clearly show the difference PliOjet makes. This plant has eleven coal-fired boilers. Eight have individual stacks, three are served by the large, striped stack. When the left-hand photo was taken, seven boilers were on the line, all served by the five stacks at right. PliOjets were purposely not operated, and the stacks smoked badly. The change may be seen at the right, only seconds after PliOjet units went into action.

requirement is still the same, or even less. The results are different, too!

With superfluous air much fuel goes to waste; with overfire air jets the air and turbulence provide higher combustion efficiency, greater utilization of fuel, and the result is more steam at less expense.

System Adaptable

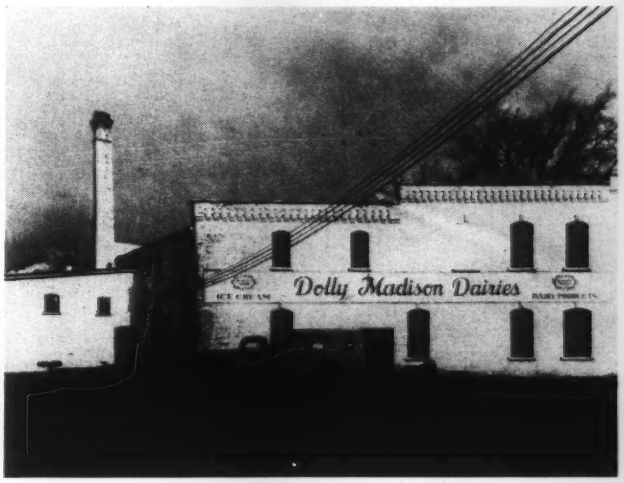
The PliOjet system is adaptable to several methods of control, including manual, semi-automatic, automatic, and electronic. With manual operation a push-button controls the starting and the stopping. In semi-automatic operation, PliOjet is started manually and then its interval of operation is determined by an adjustable time-delay relay. With stoker-fired boilers, PliOjet operation can be made fully automatic by using a time-delay relay in conjunction with the stoker starter.

Electronic control offers the optimum in efficiency, for which this type of control it is virtually the smoke itself that puts PliOjet into operation. An electric eye installed in the breeching or stack stands constant guard, looking for smoke. If it sees smoke of a predetermined density, it flashes an alert to the turbo-blower, and PliOjet goes into operation.

PliOjet overfire air systems are more economical than steam jets, since the use of steam represents a needless waste of expensive fuel and a reduction in boiler capacity. PliOjet uses air, available in abundance without cost, and electricity to operate the turbo-blower.

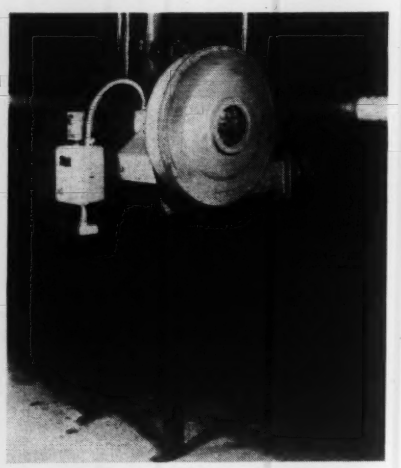
The Pittsburgh Plate Glass Company plant in Keene, N. H., discussed in the November issue, operates boilers which are primarily fired by wood shavings and sawdust, supplemented by coal. PliOjet at Ft. Holabird in Baltimore, Md., typifies the many installations made in connection with coal-fired boilers. The differ-

PliOjet equipment installed at the Dolly Madison Dairies in Reedsburg, Wis. This plant operates an H.R.T. boiler equipped with an oil burner. Since the installation of the overfire air jet system, the average fuel consumption has been reduced by some 250 gallons per day, due to increased combustion efficiency. Flues need to be cleaned only once a week instead of every day.



ence made by PliOjet at the Dolly Madison Dairies plant in Reedsburg, Wis., which operates an oil-fired boiler, is also shown.

PliOjet treats all these installations alike; being carefully engineered in each case for the specific furnace conditions, it does away with smoke—which is really nothing more than unburned coal—by providing the air and turbulence required to burn that fuel and achieve complete combustion.

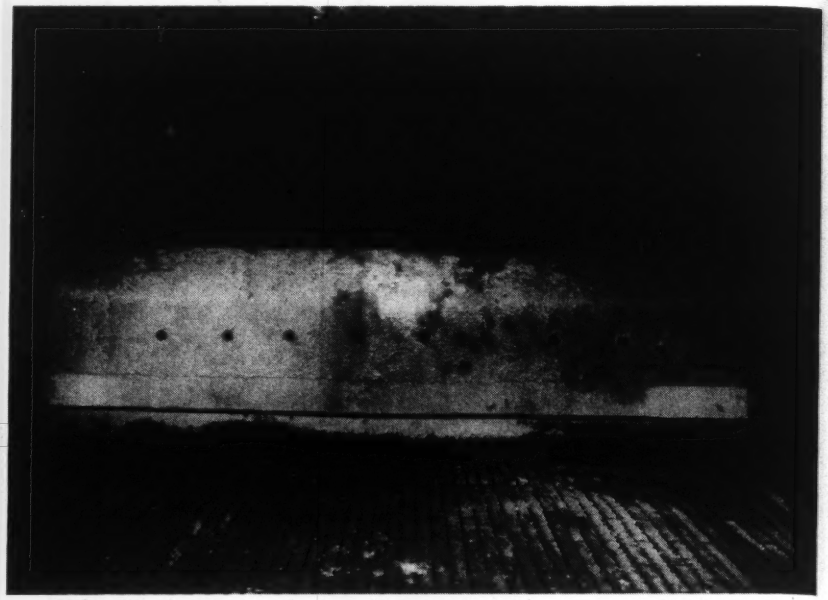


This turbo-blower is installed just outside the furnace in line with the bridge wall, but it can be placed in any convenient location.

HOW THEY GOT THAT WAY

The Plibrico Jointless Firebrick Company manufactures plastic fire brick, castable refractory, and other refractory materials. And to further the sale of these products, the company has long furnished a complete installation and boiler setting service, including an engineering service covering application, furnace construction, and furnace design.

It was quite natural, therefore, that the company would become involved with numerous applications of overfire jets, both air and steam. Its engineers noted that properly applied air jets would, in many cases, overcome improper furnace design by providing turbulence to compensate for inadequate furnace volume—to give the intimate mixture of combustibles and air which would be obtained with more efficient furnace design through

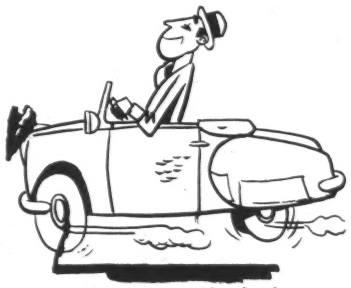


PliOjet Nozzles, in this case, as well as manifold, have been embedded in the bridge wall. Nozzles may also be inserted in the front wall, side walls, or any combination for maximum effectiveness, depending upon specific conditions.

greater furnace volume and longer flame travel.

They found that overfire air was an expedient which would in many cases greatly increase combustion efficiency and eliminate smoke at an installation cost of only a fraction of that involved in redesigning and rebuilding furnaces.

So the company got into the business of selling and installing overfire air equipment. Simple, isn't it?



Chugging to Cleveland.

THIS IS THE GROUP that met at the Engineering Institutes of the University of Wisconsin last year. Can you identify any of them? If not, come to Madison this year —May 27 and 28—when most of them will be back for a two-day program on air pollution control, which is planned for municipal staff employees, building engineers, and industrial personnel concerned with the interpretation and enforcement of smoke and air pollution ordinances.

HOW CLEVELAND AIR POLLUTION CONTROL IS SET UP

Three Bureaus Function Under Commissioner

When the members visit Cleveland during the Annual Meeting, they should budget their time to include a visit to the Cleveland Division of Air Pollution Control.

Cleveland, under the able guidance of Commissioner H. G. Dyktor, has made much progress in air pollution control, and here's how it was done:

The division was formally established on July 1, 1947, on the basis of an ordinance which permitted the Commissioner to organize three bureaus, to wit, the Bureau of Smoke Abatement, the Bureau of Industrial Nuisances, and the Bureau of Industrial Hygiene. An excellent laboratory services the entire division.

Bureau of Smoke Abatement

The Bureau of Smoke Abatement, headed by Howard J. Scott, has jurisdiction controlling the emission from all combustion devices with the exception of individual homes and row houses.

It carries on an inspection service covering some 15,000 installations. These are checked annually, and the recommendations for improvement are made and followed up. This Bureau also issues permits and certificates of operation for both new and existing installations.

The inspection service includes railroad and marine operations as well as homes.

In addition to Scott, the Bureau is staffed by a registered professional engineer, three field engineers, a chief inspector, 18 inspectors, an accountant, and three stenographers.

Bureau of Industrial Nuisances

The Bureau of Industrial Nuisances is concerned with the emission of all types from industrial process operations. The diversity of industries in the Cleveland area will give some idea of the scope of this Bureau, and the decisions for which it is held responsible:

Steel mills, chemical plants, oil refineries, fertilizer plants, foundries, paint manufacturers, rendering plants, cement plants, asphalt plants, and many others.

The Bureau investigates all these operations and works out with the technical staffs of industries the methods which will be effective for the control of their obnoxious emissions. Its staff consists of two engineers, one chemist, and one stenographer.

Commissioner Dyktor and Meteorologist Leonard Goldston with mobile equipment checking wind velocity and carrier.

Bureau of Industrial Hygiene

The Bureau of Industrial Hygiene has jurisdiction over the health aspects of environment in mills, factories, and other places of employment. Its responsibility includes the removal of contaminants from the working room in such a manner that they will not add to the general air pollution load outside.

The particular type of work involves industrial process ventilation, radiology, analysis of work room atmosphere for toxic materials, and the analysis of biochemical specimens. The staff consists of two engineers, a chemist, and a stenographer.

Chemical Engineer Dwight E. Hatch listens to the complaint of a housewife.

Laboratory

The staff of the Laboratory consists of three chemists to provide mechanical and physical analyses for the three bureaus of the division. The laboratory work, most of which is quite specialized, extends from coal analysis through microchemistry and spectrophotometry.

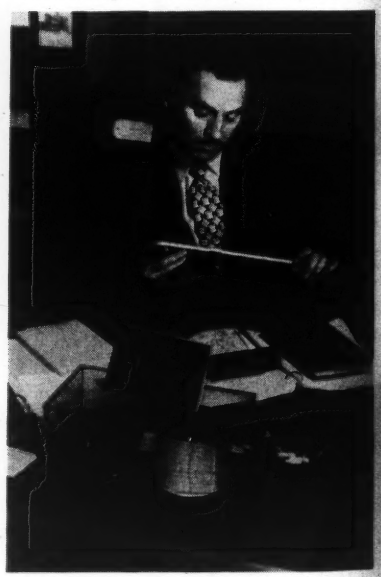
The two-fold program of the division consists of 1) routine work and alleviation of local disturbances, and 2) the study of the effect of local meteorology on the concentration and distribution of pollution as well as the study of the effect of pollution on paint, metals, and glass.

The annual budget of the division has recently been increased to $186,000—money well spent, as far as Cleveland is concerned.

Summing up the findings. Left to right: Dwight E. Hatch, LeRoy Diehl, George Craig, Commissioner Dyktor, Leonard Goldston, and Anthony Sidlow. The latter is now air pollution engineer of Green Bay, Wis.

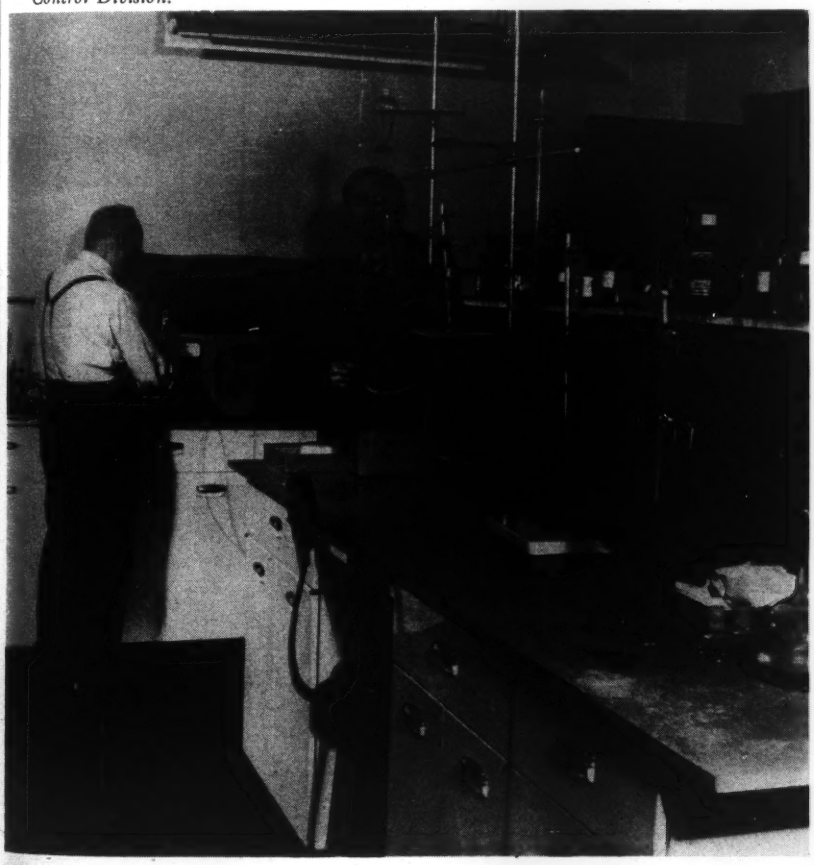
Chemist George Craig, left, operates test instruments as Mrs. Juanita Field records walkie-talkie reports made by Chemist Dwight E. Hatch.

Meteorologist Leonard Goldston at work.



Checking blue prints on new installation work prior to granting permits. Howard J. Scott, Chief, Bureau of Smoke Abatement, right, looks over the calculations of Samuel Close, his assistant.

Analyzing dust samples in the chemical laboratory of the Cleveland Air Pollution Control Division.



HOW NASHVILLE HANDLES VIOLATORS

by R. L. WALKER
Superintendent
Division of Smoke Regulation

Any success we might have had here in Nashville is due for the most part to a lot of hard work.

We have a fairly good ordinance which was written in 1947, and a new set of Rules and Regulations written in 1948. The Nashville Smoke Appeal Board has the power to write and amend regulations for the installation of fuel burning equipment, and in this way we are able to keep our regulations up to date. The current regulations have been amended five times since they were written.

We have accepted most of the standards as set out by the Technical Manual of the Stoker Manufacturers Association with regard to minimum setting heights, combustion volume and hearth area.

West Kentucky Coal

Since most of our coal is West Kentucky with a low fusion temperature ash, we allow not more than 25 pounds of coal per square foot of grate area on dead plate type stokers.

We also require a system of overfire air for the elimination of off-period smoke, one cubic foot of combustion volume for each four pounds of coal, automatic or barometric dampers and hold-fire timers so wired that they will maintain a fire during extended idle periods, such as overnight banking.

This eliminates the necessity for building fresh fires each morning. On heating units we also require a 24-hour program clock. About 90 percent of the fuel used for commercial and industrial purposes is washed No. 11 Seam.

In 1946 most of the plants were having trouble getting a fire started in the morning after the equipment had been banked overnight. This was true whether the fire had been allowed to go out or where an attempt had been made to bank the fire and also with equipment using hold-fire timers.

Ignition Trouble

The firemen were having trouble getting the coal to ignite, and were making a lot of smoke due to stirring and hand-

firing in an attempt to get the firebox hot enough to ignite the coal.

To aid the firemen in burning this fuel, and in an attempt to standardize procedure used by coal men and stoker service men when they were called in to give assistance, Information Bulletins were developed and distributed.

The main points in these bulletins are:

Step 1. Attempts to get the fire cleaned in the afternoon on heating loads and at the end of the operating period on processed steam loads rather than have the fireman clean the fire the next morning just before the equipment is returned to service.

This step allows the fireman more time in the morning when he really needs it, and also eliminates the necessity of stirring the fire just before the equipment is put in operation.

Step 2. An attempt to eliminate overcleaning fires which has been a bad practice a long time. Other steps in the bulletins emphasize the importance of proper air adjustments and the use of some type of draft control.

Barometric dampers were a great aid in maintaining firebox temperature and adequate fuel beds during the idle period of the stoker. The stoker regulations were amended to require barometric dampers on all new installation.

Annual Inspections

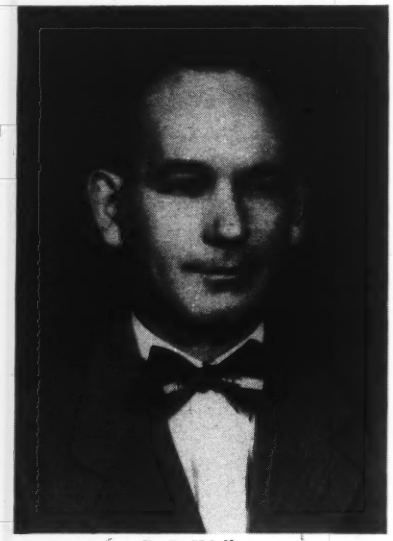
At the end of the heating season the Division of Smoke Regulation starts making annual inspections on all central plants serving commercial and industrial buildings.

When plants are found to have major defects, a certificate of operation is refused until such time as the repairs have been made and the equipment reinspected.

When the heating season starts all inspectors in the Division of Smoke Regulation start to work at daylight. Their primary duty is to make observations on stacks found to be making excessive smoke.

During the 1950-51 heating season, three inspectors made a total of 359 observations. If the observation does not result in a violation, the owner receives a letter of warning.

If the observation results in a violation, the owner receives a letter requiring



R. L. Walker
Chairman of Nominating Committee

that an answer be submitted in five days explaining why it was necessary for his plant to make smoke.

Plants having two or more violations in one heating season are given special attention and may be required to provide themselves with additional controls, install a barometric damper or make such changes as are necessary to prevent further violations.

Good Salesmanship

The Division of Smoke Regulation operates on the same theory as a good salesman. As long as any stack is making dense smoke, the owner is constantly receiving a notice of violation, and personal calls from one of the inspectors, until the condition is corrected.

Smoke departments in many cities are requiring permits and making inspections on the installation of gas-fired equipment. Some of these departments have had so much work to do that they have had no time to spend on smoke control.

We have had natural gas for several years, but the Division of Smoke Regulation requires no permits and makes no inspections, therefore, we have all our time to spend working on plants that burn solid fuel.

We lean toward a thorough and practical solution to any air pollution problem, rather than a speedy one, and may allow some plant to smoke periodically for several months before a solution is finally reached.

In closing I would like to mention that we have practically eliminated air pollution caused by railroad equipment. The conversion to diesels is 95 percent complete, and this figure is based on actual switch engine hours of operation, and the number of road engines in and out of the city.

Declaration of Independence And U.S. Constitution Preserved from Impure Air

What's in the air?

This $64 question, to which so many would like to find the answer, is of no concern—from now on—to the guardians of the Constitution and the Declartion of Independence.

For these priceless documents are now permanently preserved in specially designed enclosures from which all air has been removed.

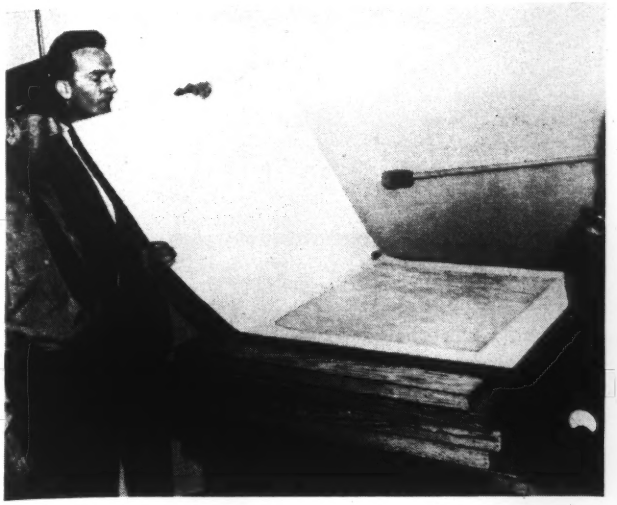
The enclosures, of glass, are filled with helium gas. The documents rest upon special cellulose backing paper in an airtight envelope consisting of two panes of glass bonded to a metal frame. The humidity is controlled.

They are exhibited in the Library of Congress in Washington behind filters and illuminated with special lights which will protect the documents from destructive light rays.

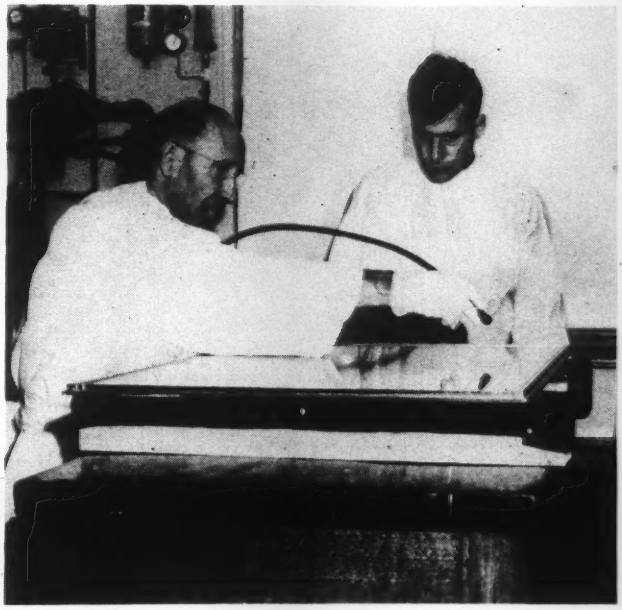
Each shrine door is covered by a laminated yellow glass filter, and the shrines are illuminated by spotlights which are protected by identical filters. Thus the documents are thoroughly protected, and the combination of colored lights and filters greatly improves the viewing of the treasures.

The Library of Congress and the National Bureau of Standards, under whose auspices the original investigation was made, have had the cooperation of the Libby-Owens-Ford Company, who made and sealed the enclosures; the Eastman Kodak Company, who made the yellow filter; and the American Window Glass Company, manufacturers of the laminated covers for the shrines.

The photographs on the next pages tell the complete story.



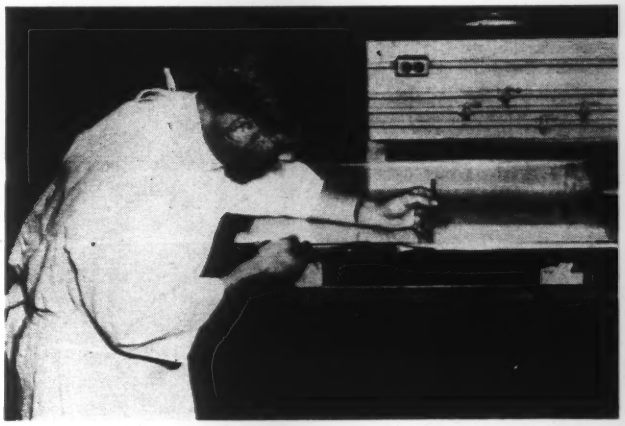
One of the sheets of the Constitution in its carrying case as it arrived at the National Bureau of Standards to be sealed in a special helium-filled glass container.

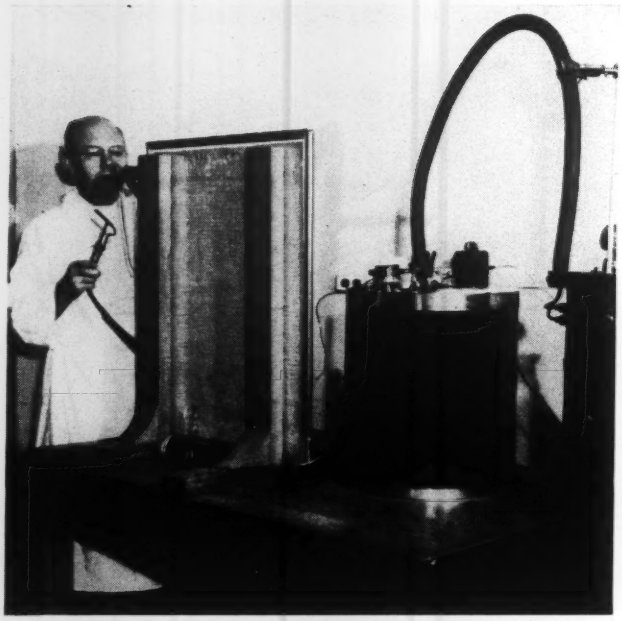


After the cover glass has been placed over the manuscript and the leak detectors installed in the lead seal and bracket, dust and foreign matter were cleaned from the enclosure with a jet of compressed air.

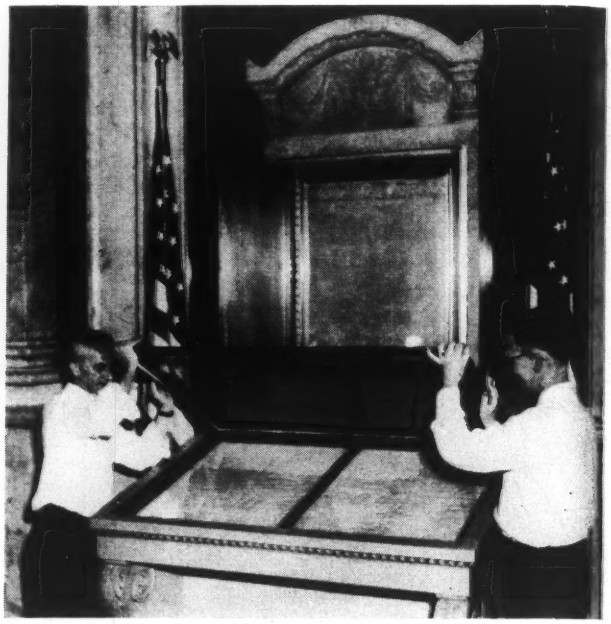
Placing the original Declaration of Independence on special backing paper. Left to right: Dr. Gordon M. Kline, Chief of the Organic Plastics Section of the Bureau of Standards; Alvin W. Kremer, Keeper of the Collections of the Library of Congress; and Dr. Luther H. Evans, Librarian of Congress.

After complete assembly, a lead strip is soldered to the glass plates in one of the most critical steps of the sealing operation. The frames are of lacquered gold-plated bronze for durability.

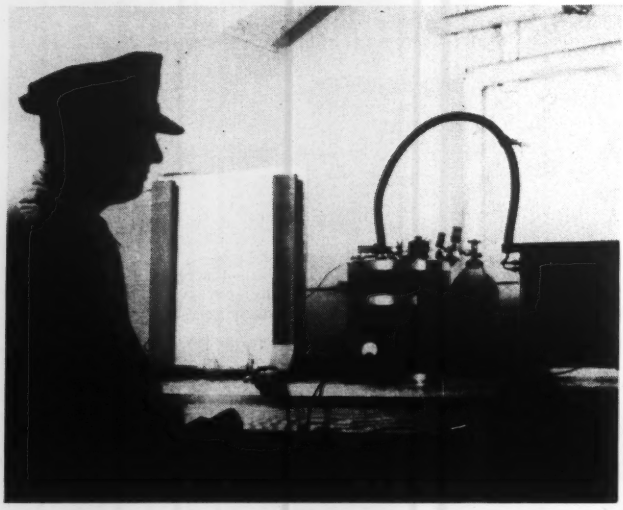




Pure helium is flushed through the enclosure. Then inlet and outlet tubes are sealed. The proper humidity is attained by passing the helium through distilled water held at a temperature of 4 to 6 deg. Centigrade.

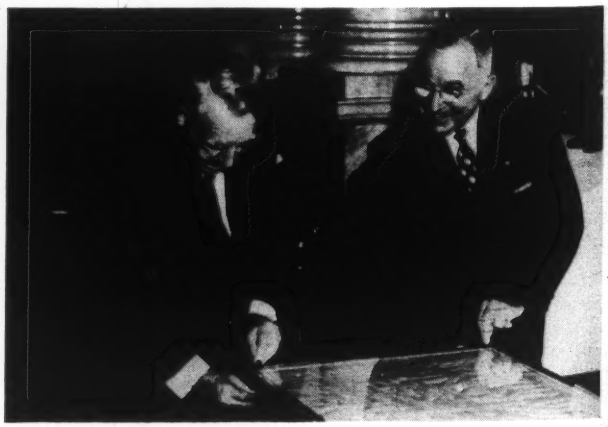


Lowering the glass lid over two enclosures containing the first and second leaves of the Constitution. The Declaration of Independence is seen in the marble shrine at the rear.



During the preserving operation both documents were constantly under surveillance by armed guards.

Chief Justice Fred M. Vinson and President Harry S. Truman clamp the final leaf of the Constitution into its enclosure prior to impressive dedication ceremonies.



Philadelphia Will Regulate Odors To Save Slighted Areas

Franklin Institute Conducts Odor Control Experiments

Philadelphia has for the first time in the United States isolated the chemical components of odors produced by specific industries, and developed methods for measuring them in such a way that they now become subject to municipal regulation. This will pave the way for the economic rejuvenation of certain areas which have become blighted by unfavorable atmospheric conditions.

The success of this far-reaching experiment was revealed by Franklin Institute at a conference sponsored by the City Planning Commission and the Redevelopment Authority.

Mayor Joseph S. Clark announced that his administration, using the results of the odor control study, "should be able to establish in Philadelphia, for the first time in America, a program for the scientific measurement and control of odors which are detrimental to the health and welfare of the citizens, and to the economic development of a city.

"The report of Franklin Institute on air pollution in the Aramingo area, dealing particularly with the control of odors, is unique. Philadelphia is proud of having this famous scientific institution apply its talents toward the problem of better air for city living."

Funds Furnished

City Council will be asked for funds to continue the study. The odor control experiments were conducted for a period of a year by Franklin Institute's Laboratories of Research and Development under the sponsorship of the City Planning Commission and the Redevelopment Authority with the cooperation of the Air Pollution Control Board.

Money for the experiment was provided by the city because of the vital interest in eliminating odors which have blighted areas such as the Aramingo section where the experiments were carried out.

In accepting the report from the Institute, Kevy K. Kaiserman, Chairman of the Redevelopment Authority, and Edward Hopkinson, Jr., Planning Commission Chairman, said in a joint statement that consideration should now be given to the possibility of strengthening the 1948 Philadelphia Air Pollution Ordinance, which "does not cover contamination by odor but rather concerns itself primarily with density of smoke and pollution" with noxious, but not obnoxious, fumes.

Odor Control Needed

Conclusions on the report were set forth at a symposium on "The Relationship Between Air Pollution Control and Industrial Land Use Planning" by Edmund Thelen, Chief of the Colloids Section, and Samuel N. Muchnick, Research Engineer, both of Franklin.

Edmund N. Bacon, Executive Director of the Philadelphia City Planning Commission, acting for Mr. Hopkinson, who was ill, declared "that while the control of smoke has long been recognized as a proper city function, little has been accomplished in municipal control of industrially produced odors, equally serious as a blighting factor, principally because no way up to now had been found to measure odors.

New Possibilities

"The devices for collecting and determining the chemical components of odors developed by Franklin Institute now open up new possibilities for municipal control in this field, so as to reduce and eliminate the blighting influence on property values over large areas."

On this same subject, Mr. Thelen said:

"The Aramingo area contains much land that is potentially valuable as sites for new industrial plants. For many years, however, it has not shared in the general industrial growth of the city.

"Realizing that odors, fumes, and other air contaminants produced in the area might well be depressing its property values and hindering its development, the city sponsored a one-year research project by Franklin Institute.

"The purpose of this project was to obtain technical information needed in making plans for the alleviation of the odor and fume problems of the area, but it turned out to have important implications for the entire city. Its major accomplishment was to show how odors can be treated as air contamination.

Practical Means Available

"In the great majority of cases, practical means are available or can be developed for the investigation and regulation of odors in the Aramingo area. Voluntary industrial precedents in other areas suggest that much effective odor abatement equipment is within economic reach of industry.

"Any requirements for the abatement of air contaminants are bound to be a burden to the plants which must comply with them. If unfair competitive advantages are to be avoided, it is seen that the plants in one section of the city cannot well be regulated if those in other sections are not."

The Aramingo area, where the experiments were conducted, extends from the Delaware River to the Philadelphia and Trenton Railroad, and from Westmoreland to Orthodox Streets. For the special requirements of the work, equipment was designed, built, and modified to collect and concentrate the chemicals causing the odors.

Equipment Described

This includes a specially constructed liquid-nitrogen condenser which cools the odorous gases to temperatures of 300 degrees below freezing. The resulting liquid is analyzed in an infra-red spectrometer which indicates the chemical compounds present. From these experiments a simple tester was designed that can identify certain malodorous compounds in the field.

Sixty-five plants in the area were studied, 23 of which were considered to produce objectionable contamination of the air, including fertilizer plants, glue factories, smoldering dumps.

Philadelphia's air pollution ordinance does not mention odors, and therefore cannot be applied to the objectionable odors which continue to blight areas where objectionable odors exist.

Need for Understanding

Norman Williams, Jr., Director of the Division of Planning of New York, declared:

"The implications for planning are concerned primarily with the location of various types of industrial areas and their impact on nearby residences, and with the need for planners to understand local climatic conditions.

"The industrial redevelopment of such an area, as a result of the elimination of air pollution, would strengthen the economic base of the city.

"The establishment of effective control of air pollution will give us more balanced communities, providing a pattern which will afford opportunities for many people to work fairly near home.

"The measurement and control of air pollution is directly in line with a marked trend in zoning, and especially in industrial zoning. More direct controls will apply to odors, which can now be measured, just as noise and smoke have already been measured."

Gordon P. Larson, Director of the Los Angeles County Air Pollution Control District, has the following to say about the development in Philadelphia:

"I believe the most significant information is the consideration of air pollution and its relation to city planning. More studies must be made in this field before full recognition will be given to the importance of this subject. Many of the future problems which may arise in this field in certain areas can be prevented with little cost, once the techniques for planning with relation to air pollution problems are known.

"The significance of the fact that a large city like Philadelphia is considering land use with reference to air pollution control is, to my mind, very important."

Samuel N. Muchnick, research engineer of the Franklin Institute Laboratories for Research and Development, right, explains freeze-out apparatus developed by the Institute for air pollution studies sponsored by Philadelphia's City Planning Commission and Redevelopment Authority with the cooperation of the Air Pollution Control Board. Watching him are, left to right, Edmund N. Bacon, Executive Director, Philadelphia City Planning Commission; Edmund Thelen, Chief, Colloid Section, Franklin Institute Laboratories for Research and Development; Walter E. Hudson, Chairman, Philadelphia Air Pollution Control Board; Francis J. Lammer, Director, Philadelphia Redevelopment Authority; and Norman Williams, Jr., Director, Division of Planning, New York Department of City Planning.

TREATMENT OF ODORS AS AIR CONTAMINANTS

by EDMUND THELEN
Chief of Colloids Section
Franklin Institute Laboratories for
Research and Development
Philadelphia, Pa.

The Aramingo area of the city of Philadelphia contains much land that is potentially valuable as sites for new industrial plants. For many years, however, it had not shared in the general industrial growth of the city. Realizing that the odors, fumes, and other air contaminants produced in the area might well be depressing its property values and hindering its development, the city sponsored a one-year research project by the Franklin Institute Laboratories for Research and Development.

The purpose of this project, which was started in July 1950, was to obtain technical information needed in the making of plans for the alleviation of the odor and fume problems of the area.

However, it turned out that the project had important implications for the entire city, and that its major accomplishment was to show how odors can be treated as air contamination. An extension of this work would lay the scientific basis for a very material alleviation of odors and other air contamination throughout the city.

The Aramingo District

All the industrial establishments in the Aramingo redevelopment area, or lying within four blocks to its south or windward side, were examined as possible sources of air contamination.

The survey did not include smoke or dust, vapors from the Delaware River, motor vehicle exhausts, and contamination reaching the area from other directions than south.

Of the 65 plants in the area surveyed, 25 were considered to produce objectionable air contamination. Of these plants

14, or 56 percent, emit odor contaminations
5, or 20 percent, emit metal fumes
3, or 12 percent, emit noxious gases
3, or 12 percent, emit carbon smoke

It was apparent, then, that odors are the most numerous and objectionable air contaminants in the area. They are also the type for whose mitigation least progress has been made generally.

It was therefore felt that both the exigencies of the project and the larger interests of science would best be served if a means could be developed for dealing effectively with air contaminants that are known to be objectionable solely because of their odors.

Approaches to Regulation

A layman's study was made of the various approaches that have been made or suggested for the regulation of air pollution. It is seen that four different bases underlie these approaches, and in some cases the philosophies embodied in them conflict strongly.

Walking delegate and frau off to Cleveland!

The first four approaches are concerned with the concentration of quantity of emission, and regulations embodying them require that certain levels of emission be not exceeded:

(a) The rigorous approach is to determine what concentrations are harmful to health, well-being, vegetation, and property, and require that contaminations remain below this level at all points in the vicinity.

This approach has been seldom used since evidence as to what constitutes a harmful concentration is, of course, extremely hard to obtain in the air pollution field.

(b) The efficiency approach is to determine how little need be emitted from a properly controlled, economically feasible plant, and to require that emissions be kept down to this level.

In effect this approach says: "Don't put out any more than you have to, whether it's harmful or not"; whereas the rigorous approach says: "You can put out all you like as long as it isn't harmful."

The efficiency approach is much used in dust and metal fume regulations that relate the allowable quantity of effluent to the amount of material being processed. In a somewhat different guise it appears in safety regulations governing permissible leakage from equipment.

(c) The superficial approach is embodied in the Ringelmann chart and other devices which measure appearance rather than concentration or quantity.

(d) The nuisance approach has long been used on odors, since to establish the offense, it only requires evidence of trespass on common law rights; it does not require any measure of physical fact of emission.

In order to avoid possible prosecution as nuisances, offensive industries for hundreds of years have located on the unpopulated fringes of towns, where there is no one to complain.

By the time the city grows out to these fringe areas, the offensive industries are well established, and since anyone moving into such areas is presumed to do so with full knowledge of their existence, the courts often are reluctant to give him relief. The area remains a depressed island around which the city eventually grows.

Control Cause

Approaches which control the cause of emissions are worth exploring; some are already used, and others could be exploited more widely:

(e) The licensing approach requires that equipment design be approved before it is installed, thus giving the licensing authority a chance to contribute its judgment to the design problem. It is realized, however, that this approval does not guarantee immunity from air pollution regulations.

(f) Under some weather conditions, odors rise from unsanitary or unsafe conditions in plants, or from plants whose inside air is concentrated with odoriferous chemicals. In such cases, insistence on standards for safety, sanitation, or industrial hygiene will help to mitigate the outside air contamination.

(g) Similarly, polluted streams and abused sewers can be prolific sources of air contamination. Use of water pollution and sewer regulations in these cases may be the most practical way to abate air pollution.

Community Planning

Approaches based on community planning are often necessary and useful:

(h) The segregation of activities by zoning is effective if the zones are laid out in harmony with the prevailing air currents, or if meteorological conditions favor rapid dissipation of contamination. They also involve the prediction that permitted industries will not at a later date adopt processes or raw materials that make them less desirable.

(i) Certain offensive practices, such as the burning of wastes on dumps, can be banned if alternative arrangements, such as for the collection and incineration or burying of trash, are provided.

(j) Condemnation, purchase, and dismantling of a plant which by its offensiveness jeopardizes the industrial growth of an area, is expensive not only of money, but of employment, taxes, and productivity as well. Nevertheless, this course is within the powers of the city, and there may be times when it is justified.

(k) Finally, industrial self-interest, stimulated by the pressure of public opinion, is still the most enlightened approach to the mitigation of air contamination. Voluntary action by the more enlightened companies, however, probably should often be followed by regulation to prevent unfair competition by rival, less public-minded companies who would otherwise fail to assume similar burdens.

Special Treatment

The table on Page 49 lists the industrial operations from which Aramingo odors are emitted, and shows the recommended abatement treatments and approaches to regulations.

Cases (c) and (g) propose that the air contamination from these operations be considered as secondary effects. In Case (c) the odors would be mitigated if water pollution regulations were obeyed.

In Case (g) the odors would be greatly reduced if decks and equipment were cleaned effectively, press-cakes and cooker residues kept dry, raw materials sprayed to delay putrefaction, etc. The odors, then, appear as by-products of questionable safety and sanitation conditions.

President Hodges proudly wears his emblem.

Cases (d) and (e) propose that the burning of rubber in smelters and the operation of burning dumps generally be superseded by the use of incinerators. This is in line with present trends in city planning.

There is a need for a device to strip hard rubber from the plate assemblies of scrap storage batteries, so that when the plates are charged into the blast furnaces, no rubber will accompany them; in the absence of such a device, care is required to prevent the burning rubber scraps.

Case (f) proposes that a small plant be shut down if the area is to be rezoned, because no way has been visualized for reducing its stench other than by rebuilding it. It is recommended that an attempt be made to balance the value of the plant in terms of employment, taxes, productivity, and profits, against its unsavory effect on the neighborhood and on future growth of the area, to see if such a proposal is justified.

General Treatment

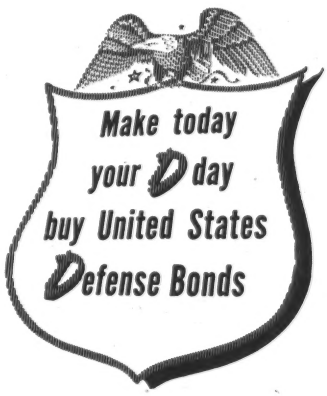
Rather fortuitously, the six of eight cases in the table which have been discussed suggest ways for dealing with air contamination by special or indirect means. Cases (a) and (b), however, propose that the chemicals causing the odors be dealt with as air pollution. It was felt that if the chemicals causing rendering plant cooker odors could be dealt with as air pollutants, a very desirable precedent would be established for defining odors in general and dealing quantitatively with them.

These steps were carried out successfully on rendering plant cooker effluvia, and are the steps required in the scientific treatment of odors in general.

(a) The odoriferous chemicals were frozen out of the cooker effluvia, and were analyzed by infrared spectroscopy and by microchemical analyses.

(b) A search was made for effective ways of trapping or destroying such emissions, and several precedents were found in industry for their abatement. Although no economic analyses were made, the fact that several plants voluntarily installed effective abatement equipment established a presumption that the abatement of cooker odors is economically feasible.

(c) Analyses showed that cooker effluvia, regardless of the charge stock, contained, among other things, sulfides, ammonia, and aldehydes. Hence a simple field tester was designed, containing indicators for these three types of chemicals:



Indicator	Chemical	Concentrations for Color Changes (ppm)	
		Rapid	Slow
Red litmus	NH_3 and amines*	1-100	
Acid Fuchsin	Aldehydes	100	10
Sodium azide-iodide	Sulfides	100	1

*Hydrolyzed with 2N KOH.

Preliminary results, some of which are yet to be confirmed, suggest that the tester can be used:

1. To detect leaks in the cooker system, or failure of the abatement equipment;

2. To detect build-up of odors inside the plant;

3. To detect rendering plant emissions at street corners, provided the meteorological factors can be dealt with.

(d) Since there is evidence that rendering plants can afford to control their emissions, and suitable abatement and detecting equipment is available, it would be technically sound to regulate cooker emissions on this principle:

"From no point in the cooker vapor or condensate system shall there be an emission of a character and concentration that will cause any of the indicators in the tester to turn color when operated under specified test conditions."

Conclusion

It is apparent that odors from virtually all other sources can also be collected and analyzed by the methods described. In most cases, once the nature of the chemicals causing specific odors are known, field detectors can be built and methods of abatement worked out if needed.

In many cases, too, industrial precedents will be found in this or other localities, to establish the presumption that it is economically feasible to mitigate the odors. Thus a scientific basis is laid for the abatement and regulation of the individual odor contaminants that together are responsible for the rich aromas that occasionally pervade the local air.

It is believed that the most valuable part of this work may be the demonstration that the chemicals responsible for odors can be dealt with scientifically as air contaminants, and as such are subject to routine regulation and abatement methods.

The extension of this work to include all the major types of odors in the locality, and to establish scientific bases for their regulation and economical abatement, is recommended as a practical, positive, and fruitful step toward the alleviation of the odor problems of the Philadelphia area.

RECOMMENDED TREATMENT OF ODORS IN THE ARAMINGO AREA

Industry	Operation	Mitigation Precedents	Approach to Regulation	Recommended Types of Abatement Treatments	No. of Sources
(a) Rendering	Cooking	Yes	Efficiency	Scrub and burn	5 X
(b) Fertilizer	Acidulator	General	Efficiency	Scrub and burn	1 X
(c) Glue	Creek used as sewer	Yes	Water pollution	Treat and run into sewer	1 X
(d) Smelter	Burning rubber	No	Banned	Separate from lead and cart away	1 X
(e) Dumps	Burning	Yes	Banned	Incineration or burial	1
(f) Tanners egg	Storage, treatment and handling	No	Condemnation or other action to shut down plant if area is to be rezoned as restricted		1 X
(g) All animal products	Storage and handling Housekeeping	No	Safety Health	Use of adequate cleaning regimen, sprays, masking agents, dry storage, etc.	8 X
					18

Note: Sources marked "X" are considered to be most offensive.

BRITAIN'S SMOKELESS ZONES

by ARNOLD MARSH
General Secretary
National Smoke Abatement Society
London

Note: This is the first of a series of articles contributed by the Editor of Smokeless Air, a quarterly devoted to problems of air pollution control in England. This contribution marks a most auspicious beginning, and the membership's thanks are herewith tendered Mr. Marsh.—Ed.

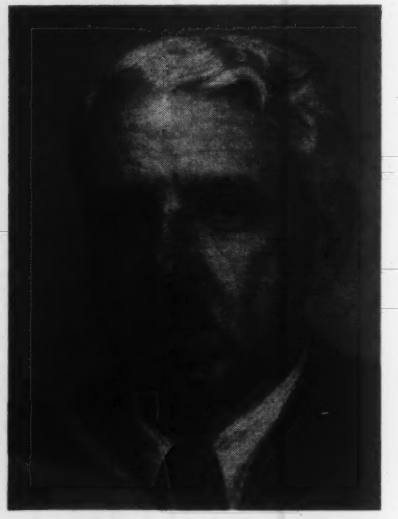
Glad though I am to write a first contribution on behalf of the National Smoke Abatement Society in Britain, I am not sure how much the readers of AIR REPAIR are aware of the differences between our respective problems and tasks.

And it would take a lot of solid writing to try to explain our situation. We have a great deal in common with you, of course, but over here we have a domestic pollution problem, due to our notorious open coal fires, that causes at least one-half the trouble and takes up the same proportion of our attention. Another big difference is that in the main our legislation is what you would regard as federal, and applies to the whole country, even though it is administered by the municipalities.

The exception to this is that since the war a number of municipalities have secured in Parliament local Acts which, though they cover all sorts of subjects, have included sections on smoke prevention on lines advocated by the National Smoke Abatement Society. First, there are powers for requiring the prior approval of plans and specifications for new fuel-burning plant (other than for private houses), and secondly, there are powers for "smokeless zones."

We in the Society are keen on the smokeless zone idea because we conceived it and have pressed hard for it. What is called a smokeless zone is a specified area in which all smoke and other pollution is completely prohibited. Any bituminous coal burning plant must be capable of being operated smokelessly, and everything else must make sure of smokeless fuels.

The idea—which may strike you as typical of British caution and patience—is that smokeless zones can be quite small and easy to begin with, and can be brought into being with little of the obstruction and technical difficulties that



Arnold Marsh

more ambitious schemes would meet. Once established, however, the zones can be extended stage by stage, according to circumstances such as the availability of smokeless fuels, new equipment, etc., until finally whole cities are areas become smokeless.

The first smokeless zone came into force in 1951, and was, appropriately enough, for the central area of the much-bombed city of Coventry. In May of this year Manchester's first zone, again for the central business area, was due to start. Others are planned, some of which take in districts of private dwelling houses.

It is, however, going to take a long time before we see progress on these lines coming as fast as we should like. We haven't enough smokeless fuel, and rearmament and export priorities are delaying the erection of the new coal carbonizing plant and the supply of smokeless boiler plant and other equipment for industry.

On the other hand, fuel shortage, due to ever-increasing demands, is making Britain more and more awake to the vast possibilities of using fuel more efficiently—and therefore without smoke. Within our limited means we are striving to bring home the truth of the fact that fuel saving and smoke prevention go hand in hand. But perhaps, if the Editor wishes, more of this another time.

SAMARITAN OF SCIENCE

BOOK REVIEW

Reading Frank Cameron's *Cottrell: Samaritan of Science* is a "must" for anyone interested in the problems of air pollution control.

The book, published by Doubleday and Company a few weeks ago, is the biography of Frederick Gardner Cottrell, the inventor of the electrostatic precipitator bearing his name, one of the leading scientific figures of the present century.

Cameron's style is amazingly lucid and far from dull. There is a breathlessness about it which carries the reader right through the 400 pages without a let-up. And why not? Cottrell was amazing by any standard.

Modest Genius

To the layman Cottrell's name is almost unknown, principally because of his own deliberate policy of self-effacement. His many patents were turned over to the Research Corporation, a non-profit foundation which today supports hundreds of projects.

Cottrell's own work consisted mainly of perfecting electrical precipitation of smoke, dust, and fumes, and the recovery of valuable materials from them.

He had "no use for money," and his ideals would not be sacrificed even for the woman he loved. From his earliest boyhood he copied the men whom he called "men of intensity." Their furious pace of work enabled them not only to keep up with the tremendous surge of technological progress, but also to make a positive contribution to it.

There were a thousand ideas Cottrell gave away—that's how active his mind was. His vital and unorthodox ingenuity underlies many modern developments in science and industry.

From his quick imagination came new techniques for making cheap fertilizers, soaps, vitamins, and building materials, for producing helium and for rocket propulsion. To his incisive suggestions are attributable much of the recent progress in the study of nuclear physics and of spectrophotometry.

Always in a Hurry

Ever since his childhood he was a man in a hurry, and before he died at 71 in 1948 he was able to accomplish much. He lived in California, but ranged the whole world in the interest of science.

After his graduation from the University of California in 1896, he pursued his studies at the University of Leipzig, from which he was graduated in 1902. He then returned to his California alma mater and taught physics.

Frederick G. Cottrell

Back in 1910, when Robert Kennedy Duncan was just getting Mellon Institute organized, he asked Cottrell to join him in Pittsburgh. Cottrell said he preferred to remain in California, but would cooperate with Pittsburgh.

"Live in Pittsburgh and cooperate with California!" Duncan urged. Cottrell declined, and thus a great scientist was lost to the Workshop of the World.

Air Pollution Studies

Duncan was engaged in a study of urban air pollution problems—the first fellowship that Mellon Institute undertook, and that is why he was so interested in enlisting Cottrell's help.

Cottrell did, however, leave California for a while. He joined the U. S. Bureau of Mines, rising eventually to director and stationed in Washington, D. C. In 1919 he was awarded the coveted Perkin medal for his work in electrical precipitation.

The studies that led to his precipitator began in 1906 with a problem concerning sulfur trioxide fumes. The first installation was made at the plant of the Hercules Powder Company at Pinole, Calif. It worked, but it was not very profitable.

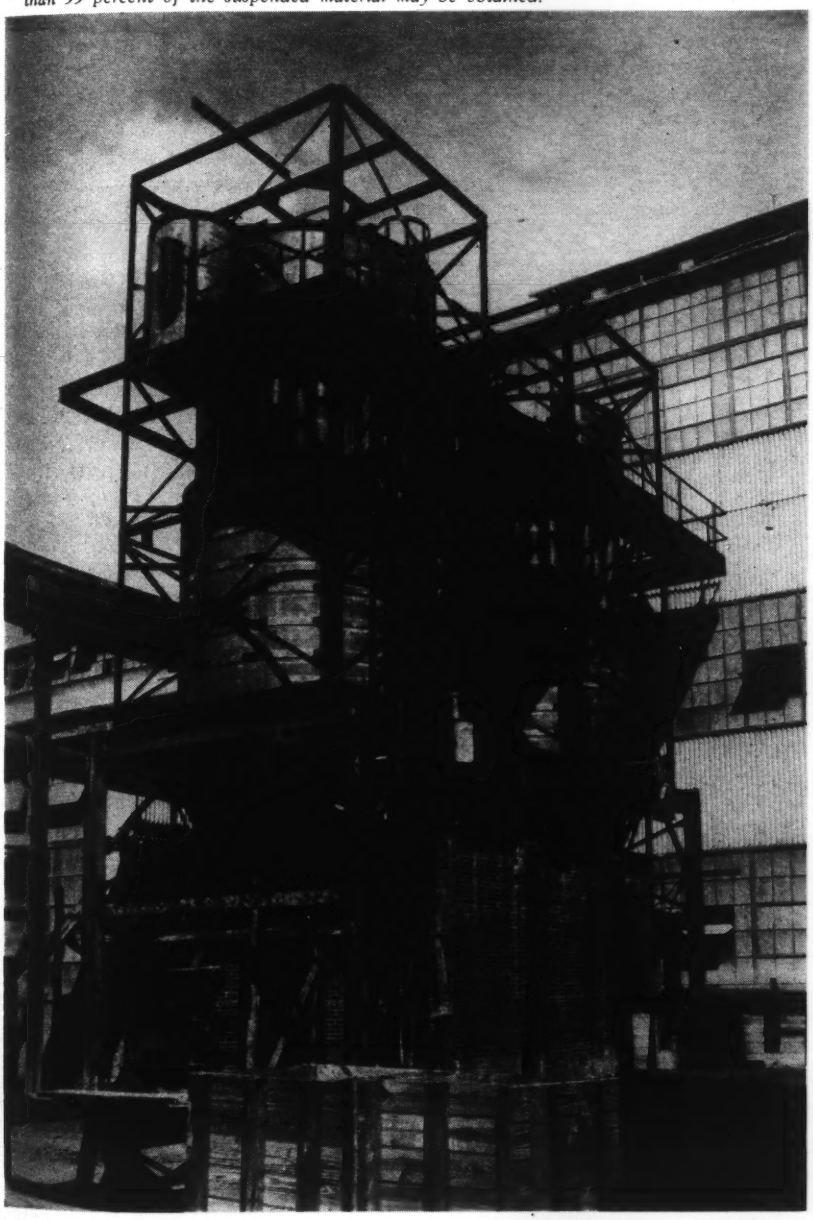
The Selby Smelter

But the nearby Selby smelter was in trouble. It had a plant near one of the tunnels of the Southern Pacific Railroad, and with certain winds, the fumes of sulfur trioxide from the silver-dissolving house would fill the tunnel with choking fumes.

Legal proceedings were started to close the plant. Cottrell rescued it by erecting a small electric plant which met the difficulty completely, yielding dilute sulfuric acid as a by-product.

When Dr. C. F. Chandler made the presentation speech at the Perkin award dinner in the Chemists' Club, New York City, he summed up Dr. Cottrell's work as follows:

Typical Cottrell precipitator. These devices may be used for the removal of practically any material, solid or liquid, that is suspended in gas, and a removal up to more than 99 percent of the suspended material may be obtained.



A Great Tribute

"Not alone has he taken the sting out of sulfuric acid waste fumes of smelters, he has brought down poisonous arsenic, saved metal dust otherwise going to waste, saved the orange groves from cement kiln smoke, and recovered potash from the cement smoke to put on those very orange groves for fertilizer. The dust in the air, which was death to the trees through the clogging of the tender pores of their leaves, when duly Cottrellized and sacked and emptied on their roots, has given them new strength and life."

It wouldn't take much urging to reprint the entire book—if Mr. Doubleday would let us—so vivid is Frank Cameron's sketch of this interesting personality.

But we haven't the space, and what's more, for $4.50 (what you'd pay for two cartons of cigarettes) you can have a copy to grace your library shelves. Order it now—you'll thank AIR REPAIR for the tip!

SOOT IS VILLAIN IN NYLON MYSTERY

The runs in New York women's nylon hosiery on several mean days last March were caused by soot, according to an explanation given to the *New York Times* by spokesmen of the E. I. du Pont de Nemours and Company laboratories

Soot, they explained, usually contains a high percentage of sulfur gases, including sulfur dioxide and sulfur trioxide. When soot is dissovled in atmospheric moisture, it thus becomes a tiny drop of sulfuric acid, which will ruin nylon.

Such tiny drops would not affect most nylon garments of loosely woven construction. But stockings, which are knitted, are under constant tension when the leg flexes in walking, and a tiny hole can start a run or several runs. Du Pont, one of the spokesmen said, has always warned wearers of nylon stockings to keep away from acids or acid-bearing fumes.

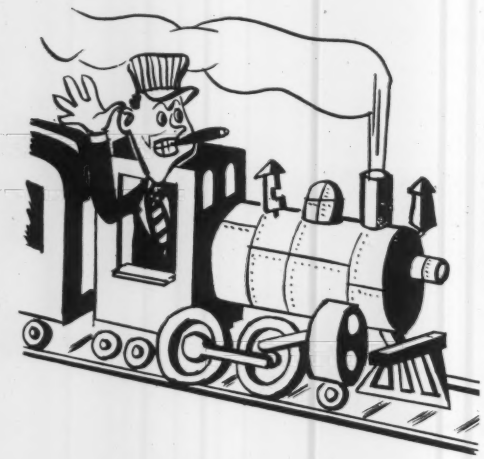
SHORTEN LONG NAME

Be prepared to hear some arguments in favor of shortening the name of our Association. It is far too long and unwieldy. When the Executive Secretary travels, he signs the hotel register "Mellon Institute" because he is a senior fellow there.

WHERE DO WE GO IN 1953?

Ever since the beginning of the year the Secretariat has been besieged with invitations to hold the 1953 Annual Meeting in one or more favored cities, and a score of hotels have written, as well as a number of chambers of commerce.

The same answer was given to all: the site will be selected from the floor of the 1952 convention, and it is up to the cities to have someone speak up for them at that time.



Railroaders want to know.

And the Editor of AIR REPAIR signified his willingness to present each case to the members through the pages of the quarterly. So here goes:

Baltimore

Milton Reizenstein, Smoke Abatement Engineer, Baltimore, and L. H. Denton, Manager of the Baltimore Convention Bureau, made a special trip to Pittsburgh to tell their story. Briefly, it's this:

Since a majority of Association members live in the northeast quadrant of the United States, Baltimore is easily reached by all of them.

They will find an interesting city, rich in historical tradition, yet alive with Twentieth Century bustle. The hotels are noted for their excellent service, and there are many interesting eating places in the city.

Entertainment abounds: there is horse racing at several tracks nearby, steamer excursions down the beautiful Chesapeake Bay, plus boating and bathing on any number of beaches.

Historically, Baltimore is well worth seeing. There is famous Fort McHenry, from whose battlements the fluttering Star Spangled Banner inspired Francis Scott Key to write his immortal song.

There is the grave of Edgar Allan Poe, Johns Hopkins Hospital, and the Naval Academy at Annapolis a few miles away.

Chicago

The brochure of invitations lying on the Executive Secretary's desk at this writing leads off with a personal letter signed by Adlai E. Stevenson, Governor of Illinois.

His invitation to Chicago is seconded by Mayor Martin H. Kennelly, as well as by Randall H. Cooper, President of the State Street Council, representing the major Chicago retail stores, by David H. Brill, President of the Greater Chicago Hotel Association, and by Chester A. Wilkins, Executive Director, Chicago Convention Bureau.

The Chicago group, early this year, was just beginning to get organized, and no doubt will put up a strong argument from the convention floor. The sentiments of the group were correctly expressed by Dan A. Sullivan, of the Commonwealth Edison Company, long-time member and staunch supporter of the Association:

"The Association was organized here in Chicago in 1907 by a small group of engineers, and you can realize the handicaps they had in furthering the movement for cleaner air more than 40 years ago.

"The organization has since greatly expanded its activities and its influence as well. I believe that if the Association would meet here in 1953 it would accomplish a great deal in the way of increasing its membership and support throughout this great industrial area."

Roanoke

The Hotel Roanoke, which was host to the 1951 annual meeting, has already reserved the dates May 3 to 8, 1953, for the Association. And the indefatigable Charlie Frost, Director of the Department of Air Pollution Control, who did so well to make last year's meeting a success, wants to do it all over again.

Milton Reizenstein

He addressed a letter to members *and their wives,* inviting them to Roanoke in 1953, and closed with:

"I will consider it a personal favor if you will vote for Roanoke at the Cleveland meeting. Thanks!"

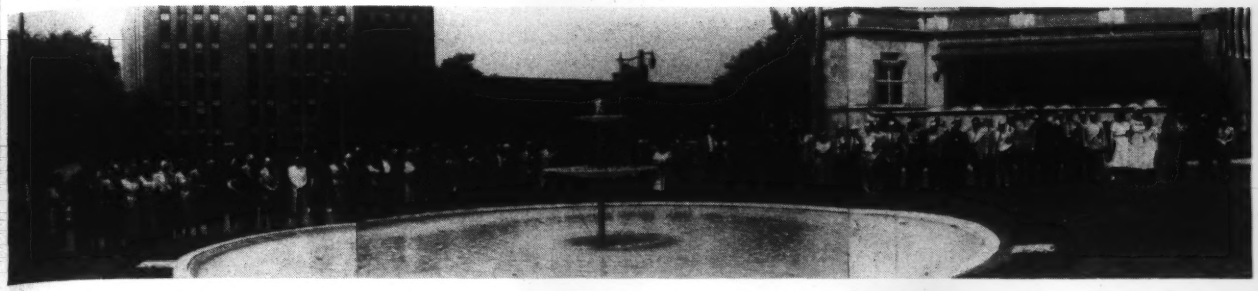
What a bear for punishment! Now, if Roanoke shouldn't get the nod, we know where the 1953 convention chairman can get a darn good utility outfielder!

St. Louis

Mayor Joseph M. Darst leads the St. Louis parade—and they mean business out there!

Interest in having the 1953 meeting in St. Louis was sparked by James H. Carter, Commissioner of Smoke Regula-

Grave of Edgar Allan Poe.



Here are a few of the 350 delegates who attended the Roanoke meeting.

tion, and G. V. Williamson, of the Union Electric Company. Gerry, who went to England for Uncle Sam a month ago, promises to stay in St. Louis if the Association holds its 1953 meeting there.

Others who seconded Mayor Darst's invitation included Harold Koplar, President of the Hotel Association of St. Louis, Richard C. Lynch, President of the Advertising Club, William H. Semsrott, President of the Associated Retailers, Andy Mungenast, Sales Manager of the Streckfus Steamers, Jack M. Lashly, President of the Municipal Theatre Association, and F. H. Rein, Secretary and General Manager, St. Louis Convention and Publicity Bureau.

Mr. Rein called attention to the fact that St. Louis is a good meeting place because:

1. Its central location.

2. Excellent convention service facilities.

3. Reasonably priced hotels with many air-conditioned rooms.

4. Many attractions. These include a municipal theater, steamer excursions on the Father of Waters, Botanical Gardens second only to Kew Gardens in London, Zoological Gardens, big league baseball.

Others

Quite a few hotels have offered their facilities. They range from Lake Placid to Jamestown, N. Y., to French Lick Springs, and to fabulous New Orleans. And, of course, we can't forget those hardy perennials, Atlantic City and White Sulphur Springs.

There are no two ways about it—people want us all right!

Above: Big league baseball is one of St. Louis' many attractions. Below: Historic Ft. McHenry, outside Baltimore, flew the flag which so thrilled Francis Scott Key that he wrote the "Star-Spangled Banner."

INCINERATION OF WOOD WASTE IN THE LOS ANGELES AREA

by ROBERT L. CHASS
Assistant Director
Air Pollution Control District
Los Angeles County, Calif.
and
EDWARD S. FELDMAN
Executive Secretary
Furniture Manufacturers' Association
of Southern California

Condensed from the Journal of the Forest Products Research Society through the courtesy of the Forest Products Laboratory, Madison, Wis. The italics are ours.—Ed.

All industrial cities are subject to man-made pollution of the atmosphere. But Los Angeles and its environs have special and peculiar problems. Los Angeles County comprises 4,083 square miles and contains 45 incorporated cities. Its population has more than doubled since 1939, and industry has expanded from approximately 1,500 establishments capable of emitting contaminants then to an established 12,000 in 1951.

Topographical and meteorological conditions aggravate the effects of the pollution produced by this population and this industry. High mountain ranges surround the Los Angeles Basin on the north and northeast. Prevailing winds during most of the year are westerly or southwesterly during the daytime.

Average wind velocity is but slightly in excess of six miles per hour. These gentle "on-shore" breezes move over the Basin from about 8:30 in the morning until midnight. After midnight a slight land breeze develops which moves down the mountain valleys toward the coast at about one mile an hour.

Such winds are relatively ineffective in their job of carrying off the polluted (offending) air by a condition of temperature inversion which prevails on approximately 260 days of the year. These inversions have been most noticeable during the summer months but in the last two years extreme inversions have occurred in the November-December period as well. They also occur in other parts of the winter when a high pressure area develops over the Great Basin.

Smog

The inversion layer is quite resistant to turbulence and acts as a lid to hold pollution near the ground. Frequently the base of the inversion is at ground level. The result is what is called "smog."

In Los Angeles this term is applied to the complex mixture of smoke, fumes, gases, and solid and liquid particles in the atmosphere. The impact of this intense mixture has wide ranging effects. Such tangible and undesirable consequences as crop damage, reduced visibility (with its interference with air travel and tourist trade), eye and throat irritation and local nuisances may be cited.

When individual city ordinances were found to be practically worthless in reducing smog, the California legislature in 1947 yielded to public clamor and adopted certain amendments to the Health and Safety Code.

This law allows any California county governing body to establish an Air Pollution Control District whenever it finds that the air is "so polluted with air contaminants as to be injurious to health, or an obstruction to the free use of property, or offensive to the senses of a considerable number of persons, so as to interfere with the comfortable enjoyment of life and property."

The principal means of enforcement is through a system of permits. It might be well at this time to quote some of the rules and regulations of the Air Pollution Control District that pertain to permits:

Rule 51. Nuisance.—A person shall not discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause or have a natural tendency to cause injury or damage to business or property.

Rule 52. Particulate Matter.—Except as otherwise provided, a person shall not discharge into the atmosphere from any source particulate matter in excess of 0.4 grains per cubic foot.

Rule 53. Specific Contaminants.—A person shall not discharge into the atmosphere any one or more of the following contaminants, in any state, or combination thereof exceeding in concentration at the point of discharge:

sulfur compounds (calculated as SO_2) 0.2 percent by volume.

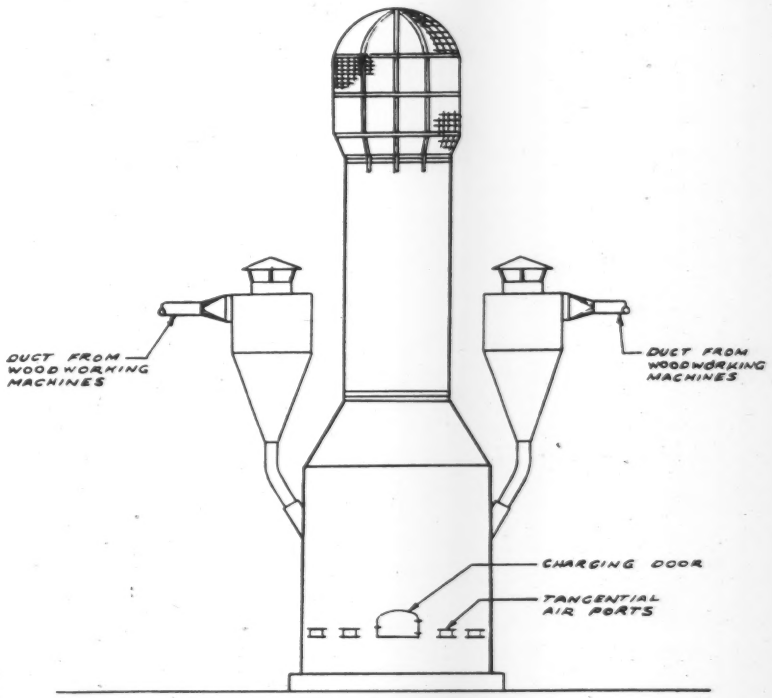
solid products of combustion 0.4 grains per cubic foot of gas calculated to 12 percent of carbon dioxide (CO_2).

Rule 54.—A person shall not discharge into the atmosphere dusts or fumes in excess of established amounts which are based upon the process weight per hour, beginning with 50 pounds and a maximum weight discharge per hour of .24 pounds, and ending with 60,000 pounds, with a maximum weight discharge per hour of 40 pounds.

The "process weight" per hour is defined as "the total weight of all materials introduced into any specific process, which process may cause any discharge into the atmosphere. Solid fuels charged will be considered as part of the process weight, but liquid and gaseous fuels and combustion air will not. The process weight per hour will be derived by dividing the total process weight by the number of hours in one complete operation from the beginning of any given process to the completion thereof, excluding any time during which the equipment is idle."

Wood Waste Incineration

When considering the wood waste in this area, we must do so with all of the above restrictions and conditions in mind This naturally makes the problem more complicated than it might be without the expressed California policy of reducing air contaminants in order to safeguard life, health, property, and the public wel-



SILO TYPE INCINERATOR
WITH MULTIPLE CYCLONE DIRECT FEED

fare, and to make possible the comfortable enjoyment of life and property.

We have merely assumed, up to now, that the incineration of wood waste contributes to the smog of Los Angeles. What are the facts? In a total pollution survey which was begun in December, 1949, the Air Pollution Control District has compiled information regarding the amount of pollution emitted by all known sources.

To date, the following 28 categories of industry have been listed:

asphalt paving plants
asphalt manufacturers
asphalt roofing manufacturers
coffee roasting operations
concrete batch plants
dumps
electric steel foundries
feed and flour mills
fertilizer plants
fish reduction plants
fish canneries, not manufacturing fish meal
garbage-feeding hog ranches
glass and frit manufacturers
gray iron foundries
meat rendering operations (other than slaughter houses)
melting and refining operations
mineral processes
nonferrous foundries
nuts, vegetable and animal oil processes
oil refineries
open-hearth steel furnaces
paint spraying operations
paint and varnish manufacturers
rock crushing operations
slaughtering houses (no rendering)
soap detergent and chemical plants
steam electric plants
meat rendering operations (in slaughtering houses)

The study is not yet complete. It is not yet known, for example, what the hydrocarbon losses are or what the industrial gas loss is. The categories have been grouped for clarity in the following manner:

Emission Sources	*Tons per day*
Industrial and municipal incinerators	153
Household incinerators	84
Metals industry	44
Minerals and earth processing	40
Food rendering, fertilizer and paint industries	20
Sulfur dioxide from fuel oil burning	269
Sulfur dioxide from sources other than fuel burning	400
Chemical, soap, and rubber plants	incomplete data
Hydrocarbon losses	incomplete data
Industrial gases	incomplete data

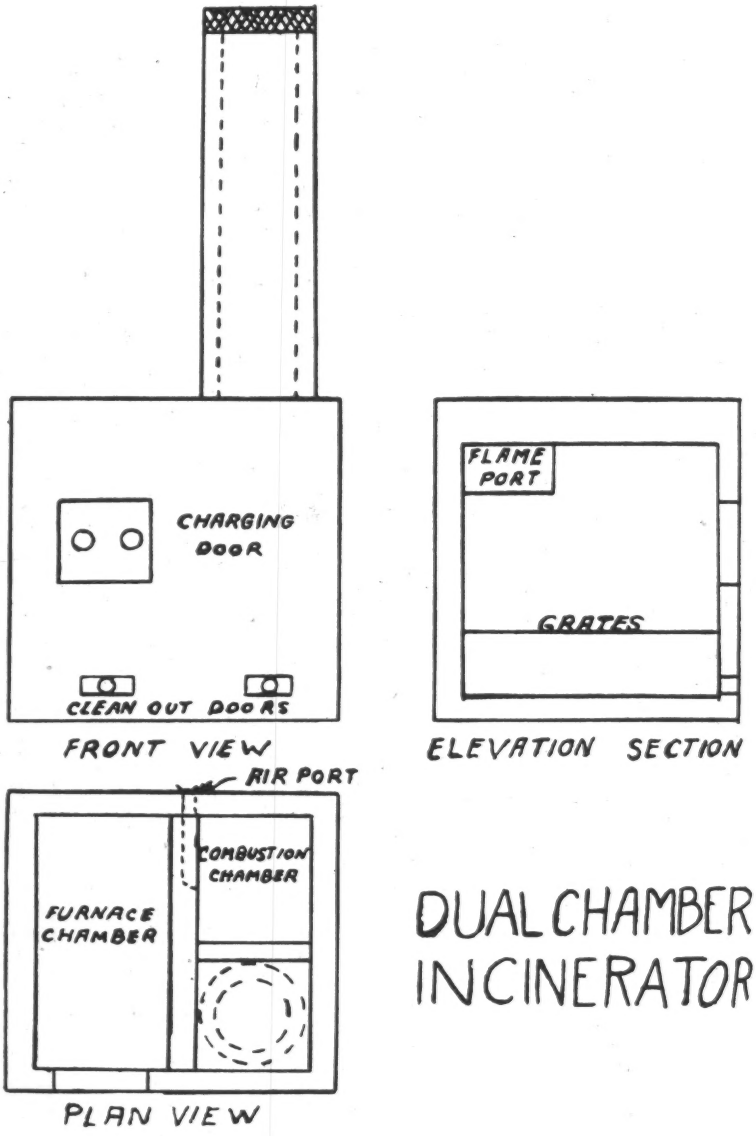
Obviously, a substantial amount of air contaminants originates in waste burning of all types. But what part of the amount which goes into the atmosphere remains there to mix with other substances to form "smog"?

Exhaustive studies reveal the following data on particle size emissions from a silo-type wood-burning incinerator:

Size of Particles Emitted	Percent of Total Emissions
0-5 microns	15.7
5-10 microns	20.3
10-20 microns	21.9
20-44 microns	25.7
44 microns and over	16.4

Particles smaller than 10 microns are not visible to the unaided eye and their rate of settling is so slow that they remain in the air for days. No less, therefore, than 36 percent of the emissions remain in the atmosphere a considerable length of time, while the particles in the "twilight zone" of 10 to 20 microns also presumably remain in the atmosphere no little time, making the final total of emissions remaining to do harm quite large.

Much improvement, nevertheless, has been noted. Thirty-five percent of the particulate matter which formerly went into the air is being collected at the source. From over 40,000 inspections and tests the District knows exactly what the various control equipment is collecting. The 1950 Annual Report points out that the industrial and municipal incin-



eration group has shown a 50 percent improvement, the houshold incinerators 17 percent, the metal industry 22 percent, the food, rendering, fertilizer and paint industries 32 percent, and the minerals and earth processors 27 percent.

The most sizeable gain has been made in reducing sulfur dioxide from chemical and refining processes by 77 percent. But no improvement has been made in reducing sulfur dioxide arising from the burning of fuel oil.

One Percent Loss

Other tests show that for each ton of wood material burned, an average of 20 pounds is lost to the atmosphere. In addition to this particulate matter, other products of the combustion of wood in incinerators are aldehydes, ketones, and acids. But we do not need the chemist or engineer to tell us that one's eyes will burn and smart when he stands in the path of smoke from a smoldering or partially burning pile of wood waste!

If the wood waste is a factor in the total smog problem, what are the alternatives to burning as a means of disposal of wood waste?

1. Wood waste, such as shavings, sawdust, and scraps could conceivably be carted away to a cut, fill and cover dump. From the standpoint only of reducing air pollution this would be an ideal solution, since burial is not burning.

> But there are numerous disadvantages. First, the tonnage is so great that cut and cover dump sites would soon be exhausted. Second, reliable transportation of the waste to such dumps is not available. Failure to remove the wood waste produced in some plants in a few hours could cripple production.

2. Utilization of the wood waste as fuel might be deemed an obvious course of action. This is the only area in the country where the millions of Btu's available from wood waste are not utilized. However, wood waste is not used for fuel because there are no facilities available to harness this great release of heat. These facilities have not been created simply because there has been no need for this heat.

> There are sufficient quantities of low cost fuel oil for the small need. Furthermore, the users of the heat are so widespread in point of plant location in the area that central heating systems are not economically feasible. And the producers of wood waste are so scattered about that collection of waste to a central place is difficult.

3. The reduction of wood waste produced would seem to have tremendous potentialities. Users of lumber, by more careful design or the use of dimension cut stock, may reduce the amounts of blocks, sawdust, scrap and so on produced when using rough lumber. Two limitations suggest themselves on the surface, however: first, the increased individual plant cost of using either more adequate design or dimension cut stock, and, secondly, the greatest part of the wood waste is not made by the lumber users, but by the lumber mills.

4. The ideal solution would be to use the wood waste for other useful products. However, the sad fact remains that it is cheaper to burn wood waste than to utilize it.

Failing other solutions we turn now to the incineration of wood waste as the most popular means of disposal in the Los Angeles area.

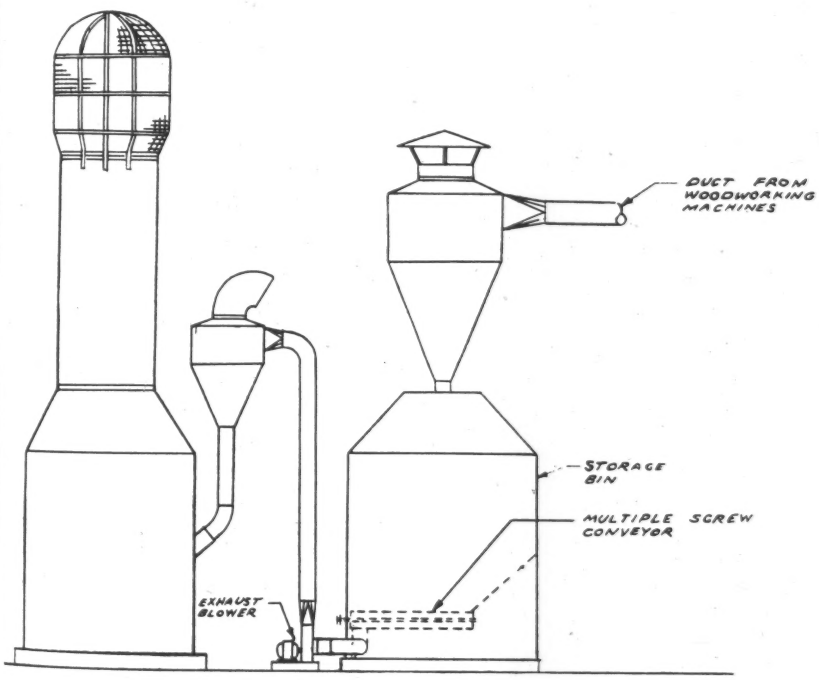
When Wood Waste Burns

Below 500 deg. F. volatiles are distilled off. Above 540 deg. F. exothermic reactions take place and the distillation of the volatile continues with the evolution of about six percent of the total available heat.

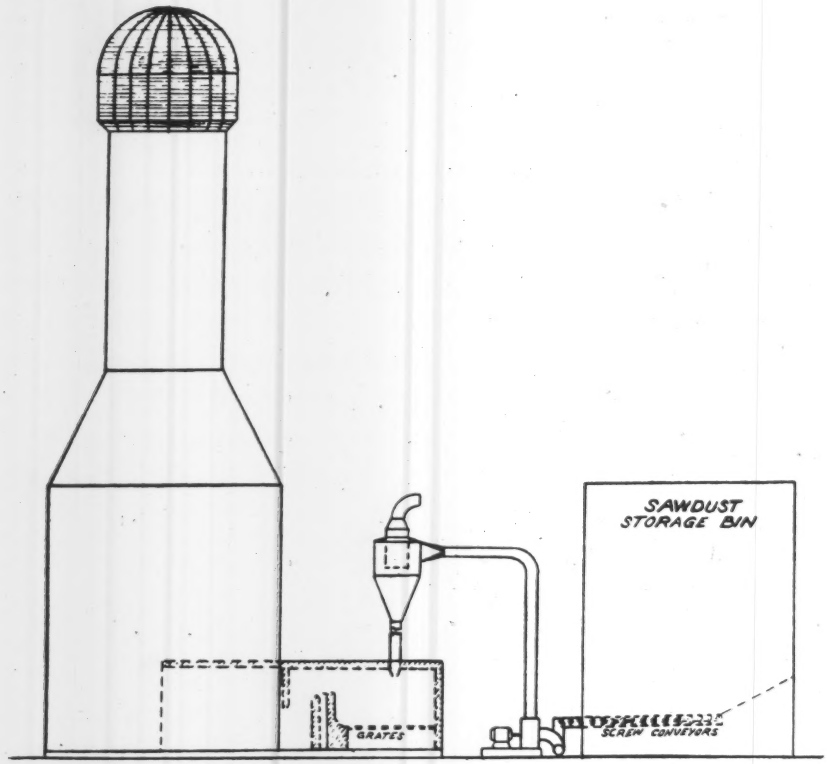
Above 1100 deg. F. volatile gases are ignited. This is true providing the woods are not too wet, since the evaporation of moisture absorbs about 1,000 Btu per pound of moisture present.

With the exception of combustion of elementary carbon, oxidation reactions occur in the gas phase. The combustion mechanism is that of rapid chain reaction. Chain reactions in the combustion of fuels are vastly complicated.

The type and predominance of the various chain steps depend to some extent upon the type of fuel, but since the essential chemical ingredients of all fuels are carbon and hydrogen, the process of burning is controlled more by external factors such as concentrations, tempera-



SILO INCINERATOR-WITH A CONTINUOUS FEED SYSTEM
NOT TO SCALE



MODIFIED SILO INCINERATOR

ture, and the manner of mixing the primary or secondary air supply, than by the difference of composition and other characteristics of the fuel. Because of their complexity, neither qualitative nor quantitative knowledge of chain reactions in combustion is complete.

At the temperature of combustion, hydrocarbons rapidly dissociate into free hydrocarbon radicals. These hydrocarbon radicals are liable to oxygen attack and highly reactive, unstable oxygenated compounds or radicals are formed which have only transitory lives.

Nevertheless, it is now generally accepted that only through successions of these active radicals are the carbon and hydrogen of fuels converted by complete combustion into carbon dioxide and water. Aldehydes, although likewise of transitory existence, are essential links in the combustion process.

The Three T's

Combusion, it is mnemonically stated, depends upon the "three Ts": temperature, time, and turbulence. These are all vital factors in efficient combustion. There must be sufficient time to ignite and burn the fuel completely; the temperature must be high enough to ignite and burn the fuel properly; and in order to burn the fuel completely, there must be sufficient turbulence in the furnace to insure thorough mixture of the gases or some will escape without being burned.

When these factors are in perfect relationship with each other, we should have smokeless burning—because we should have perfect and complete combustion. On the other hand, when they are not in harmonious relationship we have incomplete combustion which causes (1) smoke, creating a nuisance and adding to the smog; (2) eye irritants, such as aldehydes, alkyl-peroxides and other organic compounds; and (3) particulate matter (such as fly ash and soot) which may create a local nuisance. Most likely such incomplete combustion will result in violations of air pollution control laws.

In the silo-type incinerator we have no control of any of these three Ts. We can attempt some control of turbulence by the installation of air blowers or air ports. But, since the other two elements are not controlled, we will still have incomplete combustion.

As a matter of theoretical consideration, the single combustion chamber could be made to work under a system of careful feed and control. But it is not economical to do so in the small plant where we have erratic feed in type and amount and where we have only superficial attention paid to the burning operation. The reason for the existence of this type of incinerator at all is because it costs relatively little to build.

The advent of strict laws has condemned the silo type incinerator to oblivion here; for the Los Angeles County Air Pollution Control District will not grant any new permits to build or use such incinerators. An attempt has been made, by devising rules of operating procedures, to use such incinerators as were in existence prior to February, 1948.

Standard Operating Procedures

The authors of this paper have published standards of operating procedures for silo-type incinerators. The following fundamental principles behind these "hints" are simply to maximize the conditions tending toward complete combustion:

1. The California Health and Safety Code prohibits emissions of dense smoke for more than three minutes in any one hour. There are also strict limitations on emissions of particulate matter and of fumes and gases.

Any person who violates the state law or a rule or regulation of the Air Pollution Control District is guilty of a misdemeanor. This includes both the owner of the incinerator and the immediate operator.

2. Basically, as high a temperature as possible must be maintained at all times to insure complete combustion. This temperature should be at least 1200 deg. F.

3. Do not use the incinerator until enough waste material has been accumulated to warrant its use. This may mean burning the scrap or waste material some time after starting up the plant or it may mean burning it only on alternate days.

4. Incinerators are designed for a given quantity of combustibles. Should this quantity vary greatly, either black, white, or brown smoke will result.

5. Generally speaking, when black smoke is emitted, there is insufficient air getting into the incinerator. If white or brown smoke is emitted, there is too much air. (Too much air has the effect of cooling down the fire below the temperature required for complete combustion.)

6. Should the conditions in the plant change, corresponding adjustments to the incinerator should be made immediately. These changes usually mean adjusting the quantity of air getting into the incinerator or throwing in additional scrap wood to help increase the temperature.

7. There are three ways, at least, in which air can get into the incinerator:

a. through the charging door
b. through the blower system
c. through the air ports around the circumference of the incinerator

8. When the charging door is closed, and the incinerator is still emitting white or brown smoke, one of three things must be done immediately:

a. regulate the amount of air entering through the air ports
b. increase the amount of material going into the incinerator
c. or both

9. Keep the charging door closed as much as possible when the blower system is on. Keeping the charging door open when the blower system is on increases the speed with which the sawdust will leave the incinerator through the top of the screen. This will result in a heavy discharge of fly ash and a possible nuisance. It will also cool the fire quite rapidly to the point where smoke will appear.

10. Use scrap lumber to good advantage especially during such periods as the lunch hour, the time prior to the starting up of the incinerator, and any other times in which the flow of material from the machines is at a low ebb.

11. Should the practice of accumulating the material in the incinerator be followed, extreme caution should be taken to insure that there are no smoldering embers remaining. If there are, the embers and ashes should be scraped out of the incinerator or removed by some other means. Care should be exercised to prevent the material from piling up higher than one foot below discharge vent into the incinerator.

12. Do not burn so much material at one time that the flames reach the screen of the incinerator.

13. It is entirely possible to burn such materials as oily rags and materials containing paints and lacquers, providing these items are thrown into the incinerator in *very small* quantities and *only when extremely high temperatures exist.*

14. The incinerator, even though there are no moving parts, should be kept in good repair. This includes plugging all leaks in the blower system, plugging the leaks at the point where the material enters the incinerator, maintaining the devices for regulating the amount of air entering through the air ports, insuring close fit for the charging door, cleaning out the accumulated ash regularly, keeping the fire brick in good repair and maintaining a clean and whole screen on top of the incinerator.

15. Few of these rules of good operation of incinerators will operate automatically. Close surveillance must be kept on the burning operation, and action must be taken quickly when a violation is discovered.

Nor will the rules here given take care of an incinerator which is not in good repair nor will they take care of an incinerator which is not designed for the purpose for which it is used; but they will, if applied conscientiously, facilitate the use of the incinerator with a minimum of difficulty.

Since the silo-type incinerator is so difficult to control, designers have turned to multiple chamber incinerators as a solution. By virtue of its construction, this type of incinerator will overcome several of the difficulties of the single chamber. For example, the immediate escape of hot gases is retarded more easily when there is more than one chamber.

Design Important

Multiple chambered incinerators usually consist of a furnace, a mixing chamber and a combustion chamber. Certain principles of incinerator design may be deduced:

The new look on Ellis Smauder's face is caused by the emblem in his buttonhole. The emblem's yours for $3.88.

1. All incinerators shall be provided with a furnace and a combustion chamber.

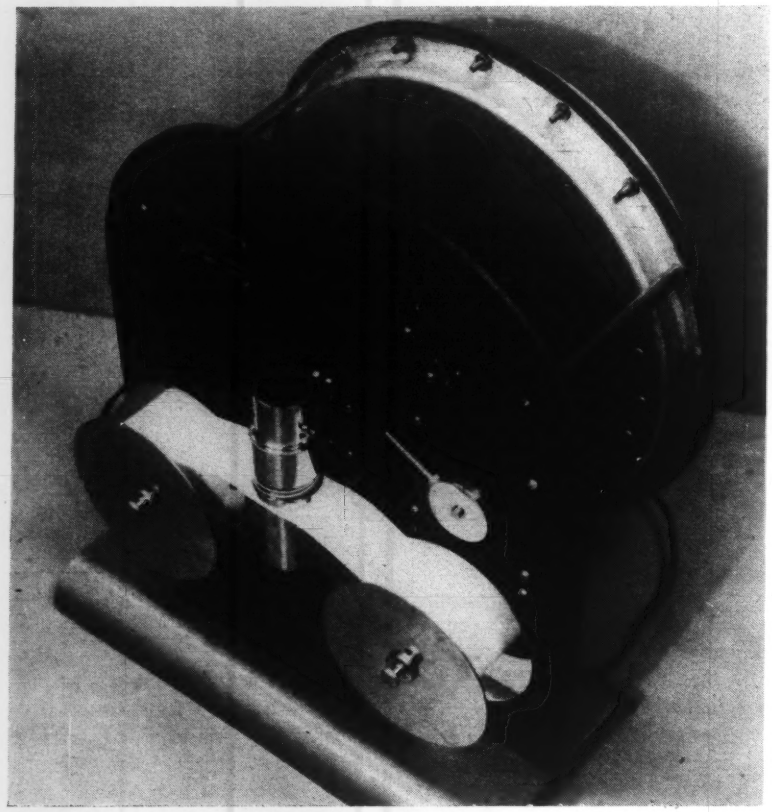
We have already seen that maintenance of adequate temperatures is an important requirement to smokeless burning. In the multiple chamber incinerator, proper temperatures are easier to maintain because retaining and bridge walls become hot refractory surfaces which receive heat from the flame and transmit it to the colder portions of the burning mixture, thus increasing the rates of ignition and combustion.

At proper temperatures, unburned gases have a chance to burn when mixed with the proper amount of air in the second chamber.

2. Provision must be made for the admission of air to the primary combustion chamber in such a manner as to initiate and facilitate proper combustion. Too little or too much air will result in smoke. The degree of combustion obtained must be such as to complete the combustion of the fixed carbon for any given fuel.

3. Provision must be made for the admission of air into the second combustion chamber to assure smokeless burning.

4. The velocity of the flue gases at the point of entrance into the secondary combustion chamber must be high enough to create a pressure adequate to insure the introduction of secondary air, and to create sufficient turbulence to insure



New Instrument Available for Air Pollution Measurement

An instrument for automatic sampling of smoke and other particulate matter in the atmosphere (described in "Instruments for Automatic Air Pollution Measurement" by W. C. L. Hemeon. Paper given at 44th Annual Meeting, May, 1951, Roanoke, Va.,) is now commercially available. Developed as a part of the air pollution research being carried out by Industrial Hygiene Foundation, at Mellon Institute, under support of American Iron and Steel Institute, it samples primarily the fine fraction of air-borne solids, e.g., smoke, is quiet in operation and low in cost. It is being produced by Research Appliances Company, 413 West View Road, Pittsburgh 9, Pa.

proper mixing of the volatile gases with the secondary air.

5. Primary and secondary air ports should be equipped with adjustable controls to enable proper quantities of air to be supplied for each chamber for all possible firing conditions.

6. Sufficient draft must be provided by either natural or artificial means to insure adequate quantities of air intake for all possible firing conditions.

7. The minimum gas temperature for both combustion chambers should be at least 1200 deg. F. if we are to assure complete combustion of all volatiles. Of course, the required temperature will depend somewhat on the type of material being burned. Auxiliary fuels, such as gas and oil, may be needed to give more adequate control of the temperature, but oil is undesirable since this adds another potential source of smoke.

8. The velocity of the gases in the secondary combustion chamber should be such as to allow sufficient time for settling of particulate matter. Turbulence, it follows from the design, is easier to maintain in the multiple chamber incinerator. A bridge wall will force the air to change direction. Secondary air, if introduced at this point, will give a turbulent effect and the added oxygen will serve to complete the combustion. The abrupt change in the direction of the gases caused by the several chambers will assist greatly in settling out the particulate matter as required by Principal 8 above.

Mechanical Devices

Some mechanical devices are available for use with all incinerators. Thus turbulence may be maintained by using a mechanical blower. Fly ash nuisance may be attacked by the use of a water spray or filter. These add, of course, to the cost of construction of the incinerator.

Mechanical smoke indicators, by themselves, do not solve the problem of incomplete combustion. They serve only to act as a warning that smoke may be too dense. A smoke indicator is certainly of little value when the stack is in the open, for the emissions from the stack should be visible to those responsible for its effective and efficient operation. When an electric eye is used, care must be taken to keep the instrument clean.

An air jet will do this. Indicators are of some value where the heat is being utilized, however, and in that case they can save money. It should be evident that it is more desirable and simpler to prevent smoke than to collect or treat it.

Operating Techniques

Although design is vitally important for the proper functioning of an incinerator, operating technique is perhaps even more important. No incinerator will work properly with improper operating procedures. For that matter, neither will a boiler operate correctly, if improperly handled.

There is an inclination, on the part of the user of the incinerator, because he earns nothing from the destruction of waste wood, to slough off the operation of his incinerator on an unskilled worker. But it is clear, as a result of existing legislation and present administration, that the task of incineration must be taken more seriously. The operating rules cited certainly offer a starting place in the education of management and employees toward cleaner and more efficient incinerator operation.

Good operation, too, will usually take care of such troublesome matters as sander dust and oily rags. Sander dust is a problem frequently encountered in the burning of wood waste. In the single chamber or silo-type incinerator, because we have so little control over time of exposure and air, the dust may go out the stack before it burns. But the multiple chamber by its nature overcomes this.

As for the "silo," there is probably no more effective solution than feeding the sander dust in with all other waste to be sure that it has a chance to be mixed with the waste and remain in the incinerator until it is completely burned. (We are not concerned here with sander dust which is so fine that it escapes from the cyclone before it gets to the incinerator.)

In this connection, it is well to consider providing a system of uniform feed for the incinerator. This will help combustion, too. A method which may be used is to provide a storage bin for the waste and to allow the waste to be fed into the incinerator by use of a conveyor belt or screw conveyor. This system can be used with single or multiple types of incinerators.

Manufacturers Can Help

Designers and manufacturers of incineration equipment will have to acquire more data about burning of wood waste. Many incinerators are designed from data taken from coal burning boilers, but experience has shown that such data cannot be used indiscriminately. We must know how much air is needed for complete combustion, where it should be introduced, the rate of air flow through the incinerator, as well as the optimum amount of refuse per square foot of grate area and proper temperatures.

The degree of utilization of combustion space must be considered, too. Definite values for the amount of space which is required for combustion are hard to find in the literature because of the large number of variables which obscure the effect of each individual variable.

Secondly, incinerator operators must take seriously the task of learning what makes the incinerator "tick," and impress upon operating personnel that there are ways in which they can make the incinerator burn in compliance with the law.

Finally, ways must be found to cut down on the amount of wood waste produced. It seems fantastic that the amount of wood waste we have mentioned at the outset should go up in flame and smoke, in just one area of this country.

WANTED

Milton Reizenstein, Baltimore's Smoke Abatement Engineer, has more than his share of troubles.

Cops the world over seem to have an affinity for him—much to his annoyance —and pick him up at the drop of a hat.

It's quite embarrassing and far from funny, since his friends think he has an honest and guileless face. To make matters worse, his own bank tellers never seem to know him.

Reizenstein's rubs with the law include:

1. North Kansas City. Picked up on suspicion of murder.
2. Baltimore. Questioned in a $5,000 robbery. He was picked up right after he came out of a meeting where he was the principal speaker. You guessed it, it was on air pollution control.
3. Poland. (During his merchant marine days.) Picked up as a suspicious character.
4. Seattle. Picked up as a suspicious character *seven minutes* after he came off his ship.

Northwest Canadians are coming to Cleveland by dog sled.

That's enough to faze any man. But Reizenstein can take these things in his stride. The 41-year-old graduate of Johns Hopkins began his professional life during the depths of the depression, when the common greeting was "Can you take it?"

He spent several years on board various steamships, traveling to many parts of the world. He eventually became a licensed marine engineer of ocean ships, but left the sea in 1935 to become an operating engineer in the steam-electric power plant of the Pennsylvania Water & Power Company at Holtwood, Pa.

A year later Reizenstein entered the employ of Babcock & Wilcox at its New York office. He served as a trouble shooter on combustion problems with various kinds of fuels, and travelled from Maine to Georgia and as far west as Kansas City.

He ran performance and efficiency tests, taught new power plant operating crews how to run equipment correctly, and took charge of installation and repairs of power plant equipment.

In 1939, Reizenstein joined Burns & Roe, Inc., in New York. They are designers and builders of steam power stations. Three years later he was made Superintendent of Construction Inspection and Testing at Ford, Bacon & Davis.

This job, like the earlier ones, consisted of considerable travel, and in 1947 he left to return to Baltimore, his home town, and seek employment there. After all, Dusty and Jeff, his two small boys, wanted to see something of their Daddy now and then. These sentiments have subsequently been echoed by Shelley, the little girl who came along two years ago.

Reizenstein worked for the Bethlehem Steel Company's construction department, later taking charge of the reconstruction of a 1,200-ft. long ore unloading dock at Sparrows Point.

In 1949 he was offered the position of senior engineer in the Baltimore Division of Smoke Control. A year later, Reizenstein became the head of the division upon the retirement of Luke Ellis, his predecessor.

His hobbies are all athletic: sailing, swimming, horseback riding. And he holds a private pilot's license for both land and sea planes. You just can't keep that man on the ground!

Smoke Abatement in Baltimore

by MILTON REIZENSTEIN
Smoke Abatement Engineer

It is now evident that the policy adopted by the Smoke Control Bureau in the beginning — "to educate where needed and regulate when necessary"—is bringing about the decrease in the volume of prohibited smoke and a general compliance with the tolerances prescribed.

The first steps toward actual smoke control in Baltimore were taken in 1932, when the Bureau was organized. Rules were adopted by the Advisory and Appeal Board after public hearings. They define tolerances and govern the installation of the various types and sizes of combustion equipment.

Complete Information Filed

Complete information on each piece of equipment must be filed and approved before a permit is issued. Drawings and specifications must accompany applications for larger equipment. This supervisory control has prevented the installation of inadequate or obsolete equipment that would be a future source of smoke.

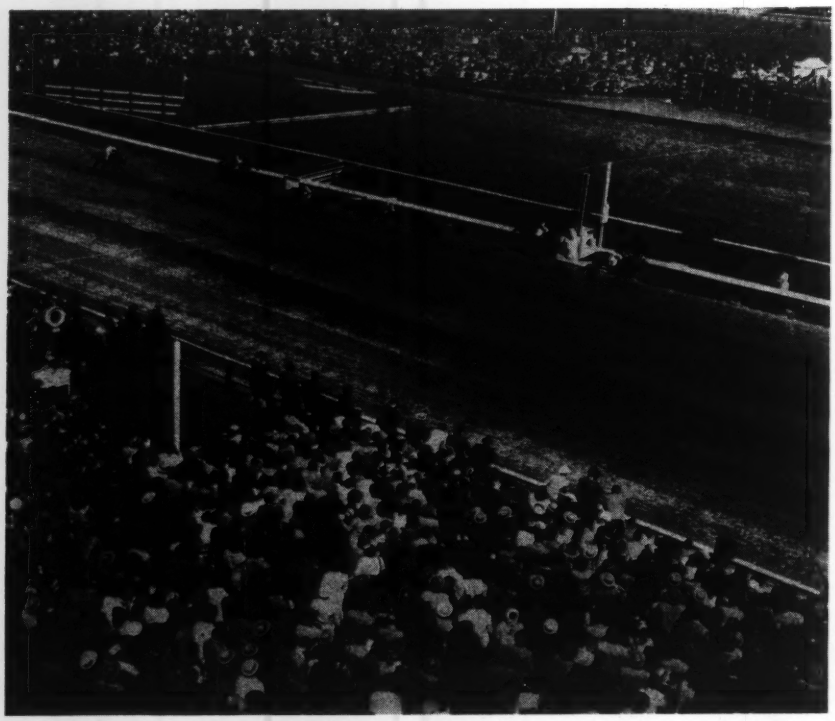
When our activities were extended to include all smoke offenders, it soon became apparent that the general public was not familiar with the terms of the ordinance. The public, therefore, had to be informed concerning fuel, firing methods, prescribed tolerances, and the like, before definite progress could be expected.

Public Educated

A survey was then made to locate and determine the number of smoking stacks in the city. This required daily observations of all offending stacks for several months. Many of the stacks had been smoking continuously for years without any effort on the part of the owners or operators to improve the conditions.

The worst offenders were given first attention. Frequent observations were necessary until corrections were made in firing method, handling equipment, etc., to insure a reduction of smoke to the prescribed degree.

Smoking down the track is about the only smoking Milton Reizenstein allows in Baltimore. Horse racing is another of the attractions which members will be able to see if the 1953 meeting is held in Baltimore.



The advantage of smoke indicating devices has been demonstrated. The firemen in tall buildings especially have less difficulty in keeping smoke under control. Without indicators of some sort to assist the firemen, they cannot know when dense smoke is being discharged from a stack which is not visible from the boiler room.

Regulations require such devices in new plants, but we have insisted upon their use in all plants where it is difficult for the firemen to observe the stacks.

Horse Before Cart?

Mechanical firing equipment has generally replaced hand firing, but there are a few instances where hand firing has replaced mechanical equipment. This unusual procedure was adopted by a prominent hotel which discarded pulverizer firing equipment and returned to hand firing—saving on fuel and abating one of the worst smoke nuisances in the city.

In the case of habitual offenders, immediate action is taken to compel compliance with the law. This class of offenders is practically eliminated, and it is now possible for many of the larger buildings to have their exterior surface cleaned for the first time since they were erected.

Coal Samples Analyzed

The practice of taking coal analysis samples was adopted as a means of informing hundreds of occasional offenders that other coal, with lower volatile content, was available. When analysis shows the coal to be unsuitable, a notice is sent the offender, urging him to change coal. The decrease in smoke resulting from this practice has justified its continuation.

Installation of modern firing equipment in large industrial plants has improved smoke conditions in their vicinity. In some places, however, the equipment reducing the smoke is also causing complaints against the emission of fly ash and solids from the stacks.

The control of fly ash emissions where there is no prohibited smoke is a matter which was not provided for in the original ordinance.

The need for legislation to effectively control the emission of fly ash and other solids became imperative in 1939, when an amendment was passed regulating

such emissions. The original ordinance with its amendments was superseded by what could be described as a revised version of the St. Louis smoke ordinance, which was adopted here in 1947.

Statewide Agency Planned

Diminishing smoke and fly ash has focused attention to the emission of gases and vapors from plants in the industrial areas. This is a problem that has followed the reduction of smoke in practically all industrial cities having chemical plants among the worst offenders.

The Division of Smoke Control has been cooperating with the Baltimore health department in an effort to control these noxious fumes pending the establishment of a statewide air pollution control agency.

CRUCIBLE STEEL TO FIGHT POLLUTION

Marvin May, combustion engineer at the Midland, Pa., works of the Crucible Steel Company of America, recently outlined the steps his company is taking to reduce air pollution in its plant towns.

May received his training on air pollution problems from a course prescribed by the American Iron and Steel Institute at Industrial Hygiene Foundation in Mellon Institute. He also obtained much valuable help from the Secretariat of AP&SPAA.

The company has started its investigation at Midland. It has already changed all its locomotives there to diesels. It will concentrate on smoke, coal ash, fumes, and dust. The largest obstacle confronting the company is the fume irritant, and a great deal of study will be necessary to eliminate this nuisance.

As far as dust is concerned, the company is in the process of putting more gas cleaning equipment into the new blast furnace, so that the dust discharge is expected to diminish.

Crucible's problem, May explained, arises from the fact that heat is continually necessary in making and processing steel. The Midland works uses 1,500,000 tons of coal a year, plus 1,000,000 tons of iron ore, 250,000 tons of limestone, 1,000,000 tons of scrap metal, and 40,000 tons of alloy materials.

Weirton Steel Puts on the Gloves

Goes After Dat Ol' Debbil Smoke Hammer and Tongs

The Weirton Steel Company is making strides toward the solution of air pollution in Weirton, W. Va. Thomas E. Millsop, President of Weirton Steel, has announced that smoke control would come to Weirton "just as fast as science tells us how to do it."

Weirton and many other steel companies are working on various phases of the smoke control program at the present time, with some firms concentrating research on blast furnaces, others on bessemers, some on open hearths, and others on methods to eliminate smoke from boiler and power plants.

The company's Smoke Control Committee, headed by Executive Chairman J. J. Munns, Vice President, Quality Control, and Co-Chairman J. Stewart Williamson, Vice President, Operations, has adopted a policy of "first things first."

Needs Analyzed

On the recommendation of Fred Harris, Weirton Steel's full-time smoke control engineer, a "needs analysis" program is being developed to determine the degree of control to be set up for the various units.

Recently Harris supervised the placement of dirt collection containers on a number of telephone poles in the Weirton area. Dust analyzed from these samples will determine which of the Weirton Steel smoke-producing operations needs first attention so far as air pollution is concerned.

Harris, a chemical engineer and graduate of Carnegie Institute of Technology, has completed an intensive training period at Mellon Institute, Pittsburgh, along with representatives of other steel-producing firms.

Industrial Hygiene Foundation, under the leadership of its Managing Director, Dr. C. Richard Walmer, and its Engineering Director, W. C. L. Hemeon, has been engaged by the American Iron and Steel Institute to make a study of air pollution.

This study has included research on the chemistry of combustion, development of low-cost instruments for the measurement of air pollution intensity at ground level, and a project on the behavior of dust particles in smokestack gases.

Public Must Be Patient

"The public must be patient," Harris pointed out. "Many people call attention to the success of the smoke control program in Pittsburgh and expect that Weirton can be cleaned up almost overnight.

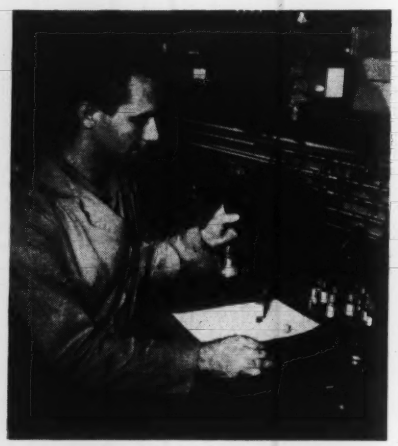
"Let me explain that the city of Pittsburgh has only one steel mill within the city limits. That plant, like Weirton, has dieselized its railroad system and is conducting research into other phases of steel-making operations."

He added that the real answers are still years away.

Hap Davis, Weirton Steel electrician, attached twelve stainless steel containers to telephone poles throughout the Weirton area. Containers will be checked periodically to determine areas of greatest air pollution and identify operations responsible for dirt content in air.

County Ordinance

The Allegheny County smoke control ordinance, pertaining to areas outside of Pittsburgh, has required that steel companies make scientific studies into smoke control problems and report within five years on their progress. No law has been passed, at this time, requiring the sudden elimination of smoke and dirt from their stacks.



Richard Full, University of Pittsburgh, prepares to analyze a dust sample.

Thomas C. Wurts, Director of the Allegheny County Bureau of Smoke Control, has offered to assist Weirton in any way that he can to help establish a smoke abatement program.

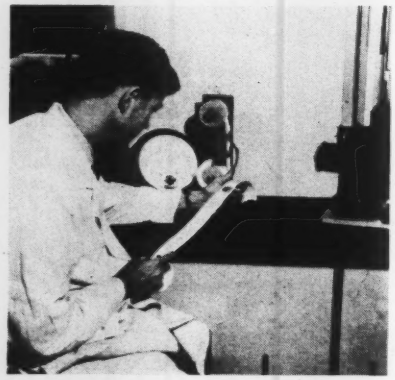
A Pittsburgh smoke control expert recently said that 75 percent of all air pollution can be attributed to nature, and "we're monkeying around with the other 25 percent."

President Millsop is working closely with Weirton Steel engineers as well as with city officials in the study of air pollution. He has a threefold interest in the project, for he is not only president of the company, but a citizen of Weirton and its mayor as well. He is taking a leading role in this civic improvement project, as he has done in all others in Weirton throughout the years.

George Haines, chemical engineer of Industrial Hygiene Foundation, demonstrates suction type dust collection instruments.

Dust particles are separated according to weight in this centrifuge being demonstrated by Fred Harris.

Bill Scheub at Mellon Institute examines the intensity of spots on the tape of an automatic smoke filter machine.



It took the Weirton Steel Company a year to get ready. That's when Fred Harris was sent to Mellon Institute to learn the technique of smoke control.

On the strength of the results of tests run throughout North Weirton, Weircrest, and Weirton Heights, Harris and his staff, acting in conjunction with experts from Mellon Institute, will determine what steps are to be taken.

The collection of interesting dust samples is going on all the time. In one case Harris descended to a basement window in order to find samples of dust settling in the lowest points.

A filter machine sucks air through a rubber tube and deposits on filter paper. The color of the spot determines the intensity of the pollution in the air. Density is generally greater in the morning. Dust samples are gathered from the sills of school buildings, from stairways, and any number of other places in addition to the samples collected from the cans.

Millie Martin, a feature writer for the Weirton *Times*, comments on the program in an interesting fashion:

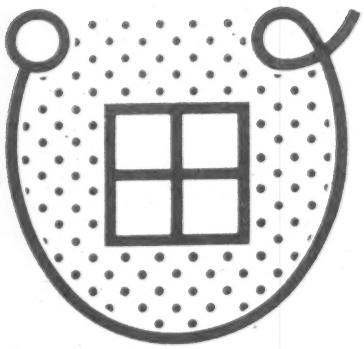
"With all these people pulling for a successful smoke abatement program in Weirton, I ask you—how can we miss? The people of Weirton must remember that Rome wasn't built in a day, and a city ordinance won't bring sunny skies or sunshine.

"The project will cost the Weirton Steel Company a lot of money, but it will make Weirton a brighter and happier place in which to live, and the people of the closely knit mill community a lot more cheerful and happy.

"The day will come when our housewives can leave their curtains up for months and months, and their houses will be easy to keep clean. This is not just a pipe dream. It is a reality. All that is needed to make the dream come true is patience. Remember that a little patience goes a long, long way."

"Yes, Miss Martin, you're right, and Weirton is approaching the problem in the right way. The program is bound to be successful.

Rufus Breland studies a Pittsburgh automatic smoke filter record for a July week in 1950. Pollution was greater during morning hours because of the morning inversion of temperature gradient.

"Good morning yourself. It's MY turn to read AIR REPAIR*!"*

—Courtesy Crucible Steel Company of America.